Bravo Automated Liquid Handling Platform

Bravo Diagnostics version 10 (2007)
for VWorks4 Automation Control software

User Guide and Addendum

Agilent Technologies

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Letter to our Customers

Dear Customer,

The Agilent Technologies acquisition of Velocity11 resulted in the following changes:

- Creation of Agilent Technologies Automation Solutions, formerly Velocity11
- Renaming of some Velocity11 products
- New Customer Service and Technical Support contact information
- New website address for product information

Please make a note of the following changes as they impact this user guide.

Velocity11 product name changes

Velocity11 product name	Changes to ...
Access2 Automated Microplate Loader	Automated Centrifuge Loader
Element Automation System	BioCel 900 System
IWorks Device Driver Programming Interface	VWorks Device Driver Interface
PlatePierce Seal Piercing Station	Microplate Seal Piercer
VCode Barcode Print and Apply Station	Microplate Barcode Labeler
Velocity11 Robot	3-Axis Robot
VHooks Integration Interface	VWorks Hooks Interface
VPrep Pipetting System	Vertical Pipetting Station
VSpin Microplate Centrifuge	Microplate Centrifuge
VStack Labware Stacker	Labware Stacker

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Bravo User Guide Addendum

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About this addendum

This addendum contains the following topics:

- *Integrating the Bravo*. Describes the concurrent operation and safe location features.
- *Delidding and relidding plates with Bravo grippers*. Describes the automated plate delidding and relidding feature.
- *Scanning microplate barcodes*. Explains how to install and use the Barcode Reader accessory.
- *Assembling the Vacuum Filtration Station during a run*. Explains how to automate the assembling of Vacuum Filtration Station components during a protocol run.
- *User Guide revisions*. Presents revisions to the existing information in the *Bravo User Guide*.

Integrating the Bravo

This section contains the following topics:

- ❑ “About the concurrent motion features” on page 4
- ❑ “Selecting the concurrent motion options” on page 6

About the concurrent motion features

About this topic

To increase throughput, you can integrate the Bravo with a plate-handling system (such as the BenchCel) or a lab automation system (such as the BioCel or a third-party system). The integration allows you to transfer a large number of plates to and from the Bravo for processing.

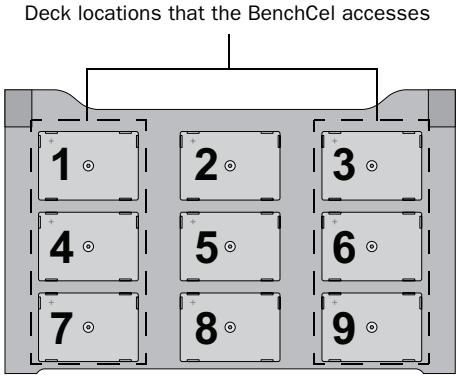
This topic describes the features you can use in the integration: concurrent operation and safe location.

Concurrent operation feature

The concurrent operation feature is used in the Bravo-BenchCel system only. The feature enables the Bravo to perform pipetting tasks while allowing the BenchCel to access another deck location concurrently. For example, the Bravo can aspirate or dispense liquid at deck location 2 while the BenchCel is placing or removing a plate at deck location 3.

If the Bravo is in the middle of a task and the BenchCel needs to access the same deck location, the BenchCel will wait for the Bravo to finish before approaching. After completing the task, the Bravo pipette head will move to another deck location to perform the next task or move to deck location 5 to avoid collision.

Note that the BenchCel always approaches the Bravo from the left side or the right side. In addition, the BenchCel can only access the left-most and right-most deck locations. Therefore, the Bravo will move its pipette head to deck location 5 (center deck location) when avoiding collision.



Bravo deck (top view)

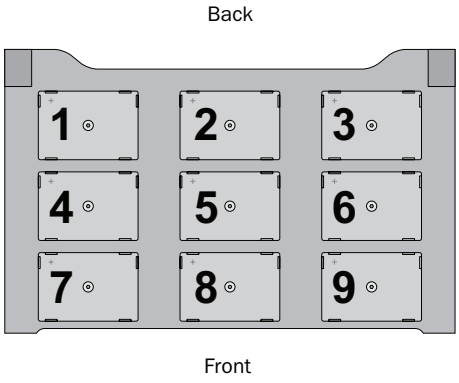
Safe location feature

The safe location feature is used in the Bravo-BioCel system or when Bravo is integrated in a third-party lab automation system. The feature:

- ❑ Allows one robot to access the Bravo deck at any given time. For example, if the Bravo is performing a liquid-handling task, the BioCel or third-party robot will wait for the Bravo to finish before approaching the deck. If the BioCel or third-party robot is placing or removing a plate from one of the deck locations, the Bravo will wait for the robot to finish.
- ❑ Enables the Bravo to move to a specified deck location (safe location) whenever the BioCel or a third-party robot approaches the deck to perform a task. For example, if you specified deck location 1 as the safe location, the Bravo pipette head will always move to deck location 1 whenever the BioCel or third-party robot approaches.

  !! IMPORTANT !! You can specify any deck location as the safe location. However, you should determine the relative position of the BioCel or third-party robot and its approach direction before specifying the Bravo safe location.

  Use the following diagram to facilitate the planning of the integration and safe-location specification.



Selecting the concurrent motion options

About this topic

This topic explains how to use the concurrent operation and the safe location features.

Using the features

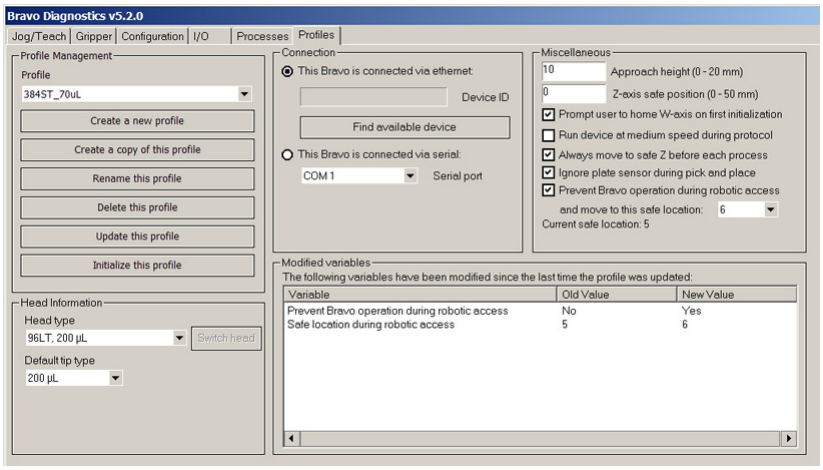
To use the concurrent operation or the safe location feature, you need to:

- ❑ Set up the teachpoints for the locations that the Bravo and the other lab automation system robot will access. For instructions, see the relevant user documentation: the *Bravo User Guide*, the *BenchCel Microplate Handling Workstation User Guide*, the *BioCel User Guide*, or the user documentation for the third-party lab automation system.
- ❑ Select the appropriate option in Bravo Diagnostics.

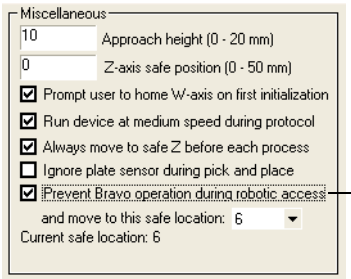
Selecting the options in Bravo Diagnostics

To select the appropriate option in Bravo Diagnostics:

1. Open **Bravo Diagnostics.**
2. Click the **Profiles** tab.



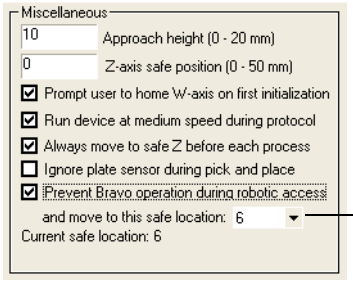
3. In the **Miscellaneous** area:
   - ◆ To use the concurrent operation feature, clear the **Prevent Bravo operation during robot access** check box.
   - ◆ To use the safe location feature, select **Prevent Bravo operation during robot access.**


Miscellaneous
10
Approach height (0 - 20 mm)
0
Z-axis safe position (0 - 50 mm)
Prompt user to home W-axis on first initialization
Run device at medium speed during protocol
Always move to safe Z before each process
Ignore plate sensor during pick and place
Prevent Bravo operation during robotic access
and move to this safe location: 6
Current safe location: 6

Clear the check box to use the concurrent operation feature. Select the option to use the safe location feature.

4. In the **and move to this location** list, select the safe location.

   !! IMPORTANT !! If you are using the concurrent operation feature, the list is unavailable. The default safe location is 5.


Miscellaneous
10
Approach height (0 - 20 mm)
0
Z-axis safe position (0 - 50 mm)
Prompt user to home W-axis on first initialization
Run device at medium speed during protocol
Always move to safe Z before each process
Ignore plate sensor during pick and place
Prevent Bravo operation during robotic access
and move to this safe location: 6
Current safe location: 6
Specify the Bravo safe location.

5. When you are finished, click **Update this Profile.**

Delidding and relidding plates with Bravo grippers

This section contains the following topics:

- ❑ "Automating plate delidding and relidding" on page 10
- ❑ "Configuring a platepad for delidding" on page 10
- ❑ "Setting the task parameters" on page 12

Automating plate delidding and relidding

About this topic

This topic explains how you can automate plate delidding and relidding on the Bravo Platform.

Delid and Relid tasks

To automate plate delidding and relidding, you can use the Delid and Relid tasks in the VWorks4 software. The Delid task enables Bravo to remove a lid from a plate and place the lid on a designated platepad. The Relid task enables the Bravo to pick up the lid from the platepad and place it back on the plate.

Using the tasks

To use the Delid and Relid tasks, you need to:

- ❑ Configure a platepad to accept a lid during a Delid task.
- ❑ Add the Delid and Relid tasks to the protocol.

Configuring a platepad for delidding

About this topic

This topic explains how to configure a platepad to accept a lid in a delidding process.

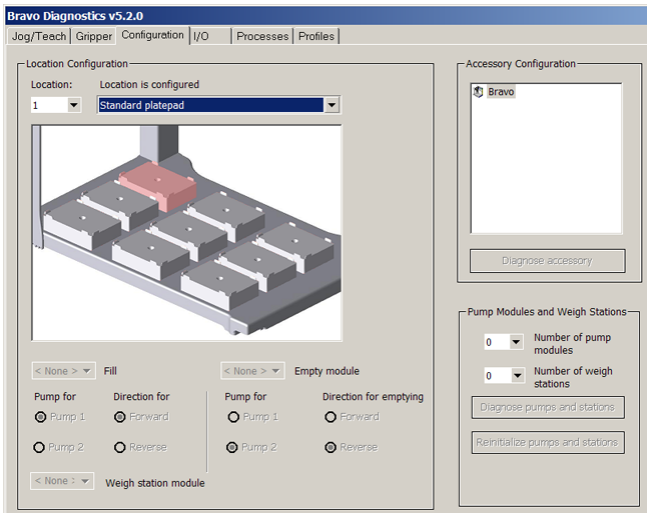
Before you start

Make sure you install a platepad at the desired deck location. Do not install another accessory at this deck location.

Configuring a platepad

To configure a platepad for delidding:

1. Open **Bravo Diagnostics.**
2. Click the **Configuration** tab.



3. In the **Location is configured** list, select **Accessory.** The Accessories Wizard dialog box appears.
4. Follow the instructions in the Accessories Wizard dialog box to:
   - Specify the **Location** on which you want to place the plate lid. Your selection in this dialog box overrides the default selection in the Configuration tab.
   - Select the **Lid Hotel** accessory to indicate that you want to use the Delidding and Relidding tasks.

   Note: Because you can only place one lid on the designated platepad, **Number of Slots** is set to 1.
5. When you are finished, click **OK** in the **Configuration** tab.
6. Make sure a platepad is installed at the location you selected in the Accessories Wizard. For instructions, see the *Bravo User Guide*.

   !! IMPORTANT !! Remember the deck location that is assigned for the Delid task. Do not physically install an accessory on a platepad that has been configured for the Delid task in Bravo Diagnostics.

Setting the task parameters

About this topic

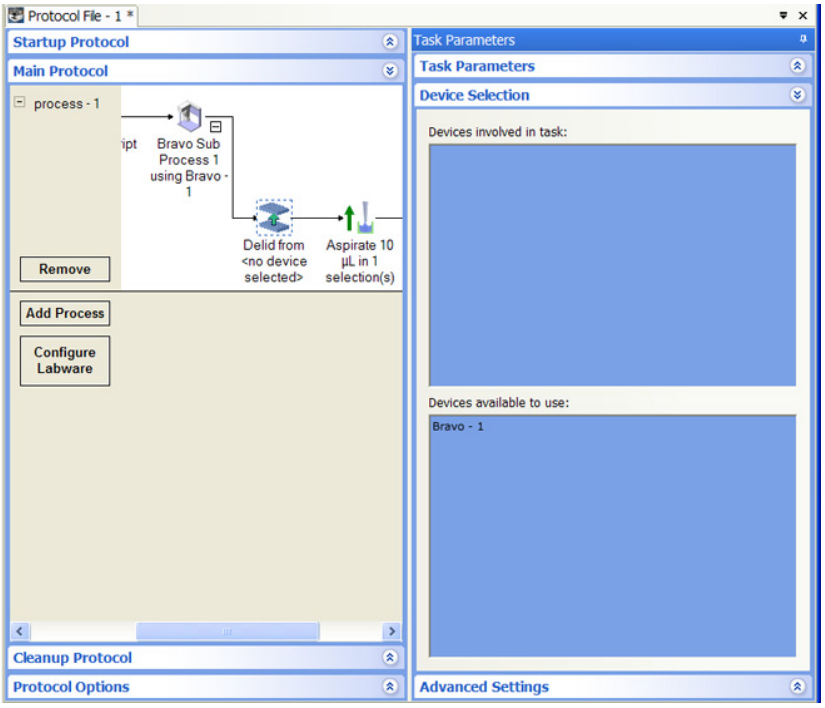
This topic explains how to add the Delid and Relid tasks and set the associated task parameters in the VWorks4 software.

Note: You can only delid process plates and configured labware. You cannot delid static labware. See the *VWorks4 User Guide Addendum* for the definitions.

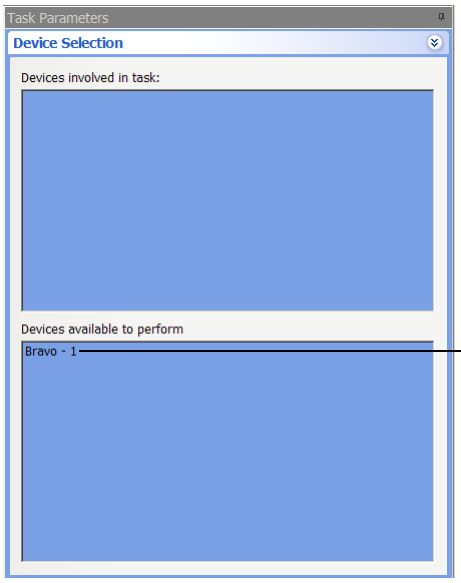
Setting the Delid task parameters

To set the Delid task parameters:

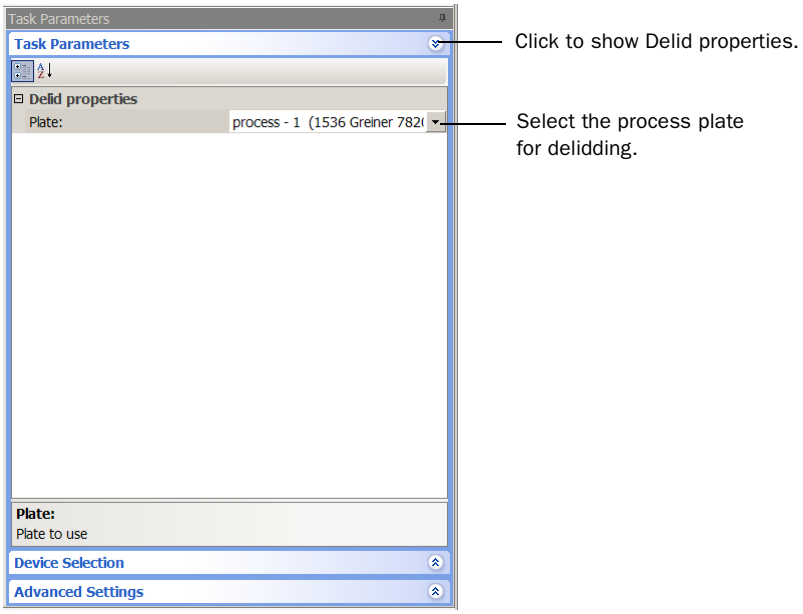
1. In the VWorks4 window, create a new protocol.
2. At the desired point in the main process or a Bravo Sub-Process, add the task.
3. Select the **Delid** task in the main process or sub-process. The Device Selection area displays to the right of the Protocol workspace tab.



4. In the **Devices available to perform** list, double-click a Bravo device. The device appears in the **Devices involved in task** list above.



5. If the Delid task is in a Bravo Sub-Process, click **Task Parameters.** In the **Delid Properties** table, select the process that contains the plate for delidding.

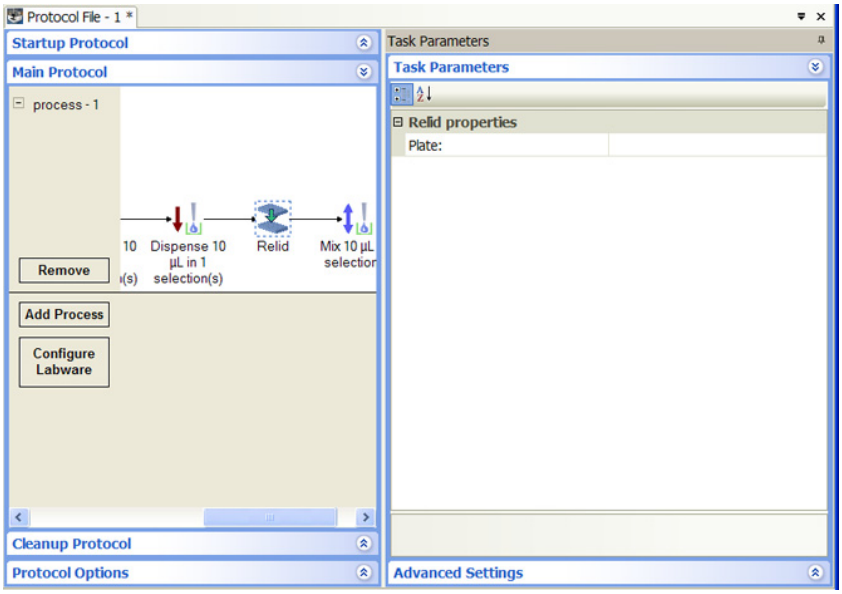


6. Continue to add tasks to the protocol.

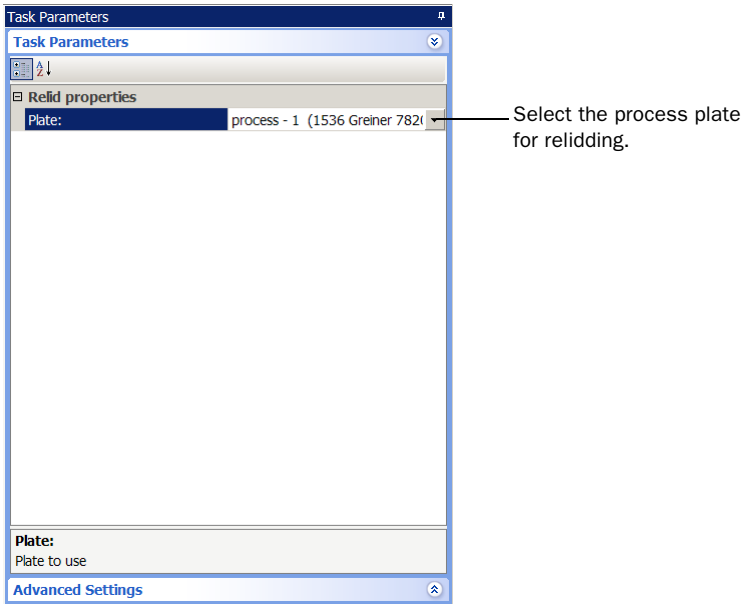
Setting the Relid task parameters

To set the Relid task parameters:

1. At the desired point in the main process or sub-process, add the task.
2. If the Relid task is in a Bravo Sub-Process, select the **Relid** task in the sub-process. The Task Parameters area displays to the right of the Protocol workspace tab.



3. If the Relid task is in a Bravo Sub-Process, in the **Relid Properties** table, select the process that contains the plate for relidding.



4. Continue to add tasks and finish creating the protocol.

Scanning microplate barcodes

This section contains the following topics:

- ❑ “Barcode Reader description” on page 16
- ❑ “Barcode label requirements” on page 17
- ❑ “Installing and removing the Barcode Reader” on page 18
- ❑ “Creating a profile for the Barcode Reader” on page 19
- ❑ “Setting up the Barcode Reader” on page 22
- ❑ “Using the Barcode Reader” on page 25

Barcode Reader description

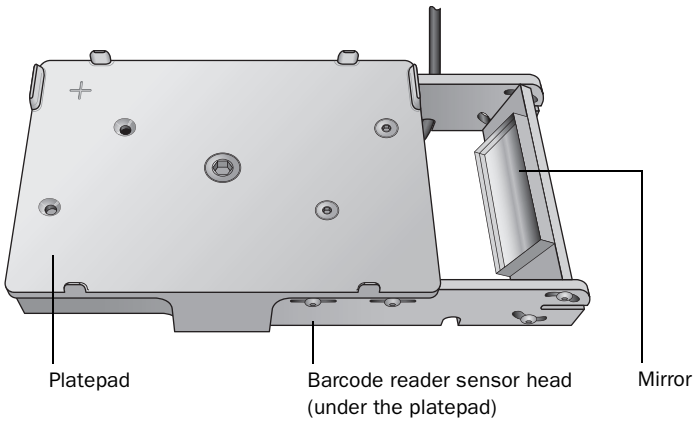
About this topic

This topic describes the Barcode Reader and provides the workflow for installation, setup, and operation using VWorks Benchtop, Version 4.

Description

The Barcode Reader consists of a platepad with a barcode reader sensor head (under the platepad) and a mirror. The Barcode Reader can be installed in place of a platepad at any deck location and is designed to scan barcodes on the east or west side of microplates.

The following diagram shows the Barcode Reader. In this diagram, the Barcode Reader is oriented to scan barcodes on the east side of microplates.



Workflow

The following table presents the workflow for installing, setting up, and operating the Barcode Reader.

Step	Procedure	See...
1	Check barcode requirements.	“Barcode label requirements” on page 17
2	Install the Barcode Reader.	“Installing and removing the Barcode Reader” on page 18
3	Create a profile for the Barcode Reader.	“Creating a profile for the Barcode Reader” on page 19
4	Specify the Barcode Reader location in the Bravo device file.	“Specifying the Barcode Reader location” on page 20
5	Set up the Barcode Reader.	“Setting up the Barcode Reader” on page 22
6	Use the Barcode Reader.	“Using the Barcode Reader” on page 25

Barcode label requirements

About this topic

To ensure successful scans, the barcodes must meet specific requirements. This topic lists the requirements for the barcodes.

Barcode specifications

The barcodes must meet the following requirements:

Characteristic	Requirement
Barcode formats	Code 39 Codabar Code 128 Interleaved 2 of 5 Code 93 UPC/EAN Pharmacode PDF417
Barcode height	3.34 mm (0.13 in) or taller
Print contrast	25% at 650 nm
Quiet zone	10 times the dimension of the narrowest element in the barcode or 0.25 in, whichever is greater

Installing and removing the Barcode Reader

About this topic

This topic explains how to install and remove the Barcode Reader.

Before you start

Make sure you have the following:

- ❑ Barcode Reader
- ❑ M4 hex wrench
- ❑ Accessories Hub

Installing the Barcode Reader

!! INJURY HAZARD !! Turn off the Bravo before you install or remove the accessory.

To install the Barcode Reader:

1. Using the M4 hex wrench, remove the screw in the center of the platepad and remove the platepad.
2. Place the Barcode Reader at the same deck location in the correct orientation to scan barcodes on the west side or the east side of microplates. Make sure it sits level on the deck.
3. Insert the supplied flathead cap screw into the center of the Barcode Reader platepad and use the M4 hex wrench to tighten the screw.
4. Connect the cable from the Barcode Reader to the Barcode Reader module port on the Accessories Hub.
5. Edit the teachpoint for this location.

Removing the Barcode Reader

To remove the Barcode Reader:

1. Disconnect the Barcode Reader cable from the Accessories Hub.
2. Using the M4 hex wrench, remove the screw in the center of the Barcode Reader and remove the Barcode Reader.
3. Place a platepad at the same deck location.
4. Insert the supplied flathead cap screw into the center of the platepad and use the M4 hex wrench to tighten the screw.

Creating a profile for the Barcode Reader

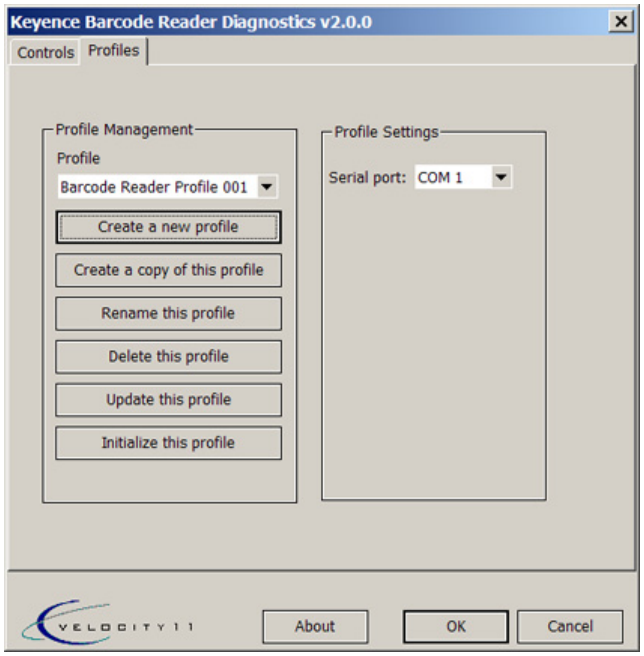
About this topic

This topic explains how to create a profile for the Barcode Reader.

Procedure

To create a profile for the Barcode Reader:

1. In the VWorks4 window, create a new or open an existing Bravo device file.
2. In the **Available Devices** area, double-click to add the Barcode Reader to the Devices area.
3. In the **Devices** area, select the **Keyence Barcode Reader** device and click **Device diagnostics.** The Keyence Barcode Reader Diagnostics dialog box opens.



4. Click the **Profiles** tab.
5. In the **Profile Management** area, click **Create Profile.** The Create Profile dialog box opens.
6. Type a name for the new profile and click **OK.** The new profile name appears in the Profile list.
7. In the **Profile Settings** area, select the Accessories Hub **Serial port** that is connected to the Barcode Reader.
8. Click **Update this profile** to save the newly created profile.
9. Click **Initialize this profile** to establish communication with the Barcode Reader.

Specifying the Barcode Reader location

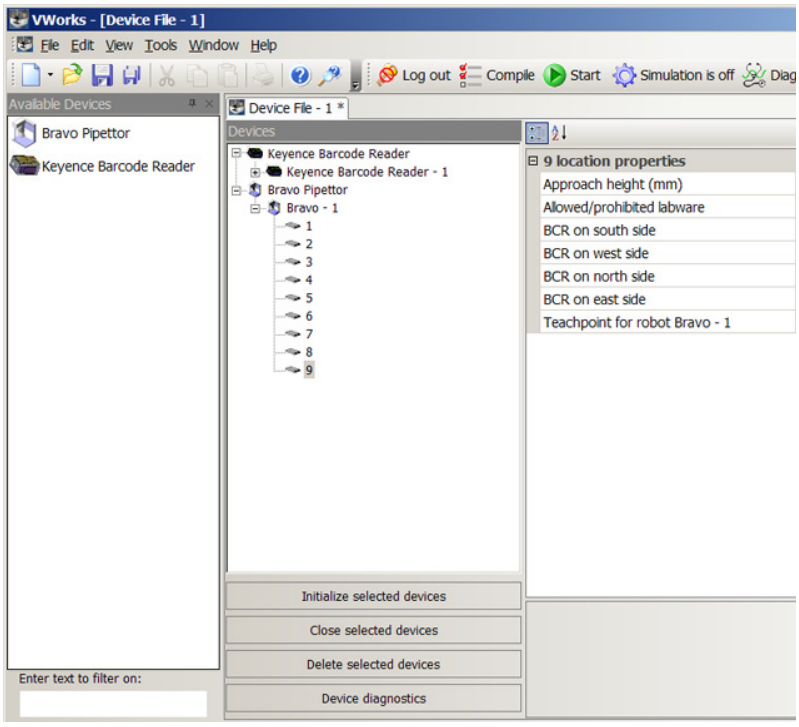
About this topic

This topic explains how to specify the location of the Barcode Reader in the Bravo device file.

Procedure

To specify the Barcode Reader location in the Bravo device file:

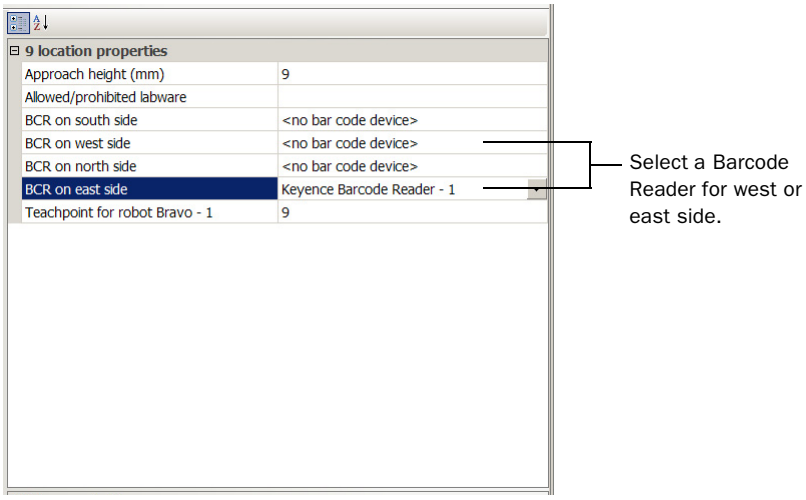
1. Open the Bravo device file that contains the Keyence Barcode Reader device.
2. In the **Devices** area, expand the **Bravo** device. The list of deck locations appear.



3. Select the deck location at which you installed the Barcode Reader. In the example in step 2, the Barcode Reader is installed at deck location 9, so deck location 9 is selected.
4. In the **location properties** table, select the Barcode Reader for one of the following:
   - **BCR on west side**
   - **BCR on east side**

   Note: Do not select the north or south sides. The Bravo Barcode Reader is only able to scan barcode labels on a microplate's east and west sides.

In the following example, the Barcode Reader is at deck location 9, and it will scan barcodes on the east side of microplates.



5. When you are finished, click **Initialize selected devices** to re-establish communication with the Bravo and use the updated device file.

Setting up the Barcode Reader

About this topic

This topic explains how to adjust the angle of the mirror to optimize barcode scanning.

Before you start

Make sure you have the following:

- ❑ M2 hex wrench
- ❑ Spare microplate that has a barcode label

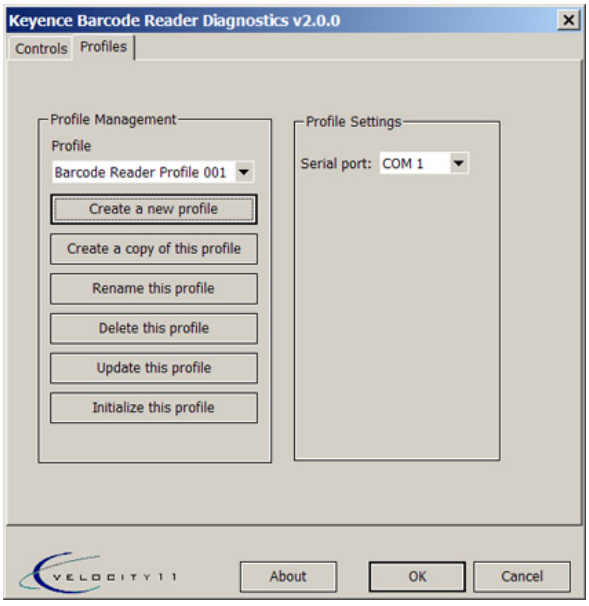
Procedure

!! INJURY HAZARD !! The barcode reader sensor head contains a class II laser that emits light at 650 nm, producing up to 1.5 mW of energy. Do not look directly into the laser beam. Looking directly into the laser beam or looking at the reflected beam can cause eye injury.

!! INJURY HAZARD !! Do not disassemble the barcode reader sensor head. Laser emission does not automatically turn off if the sensor head is disassembled.

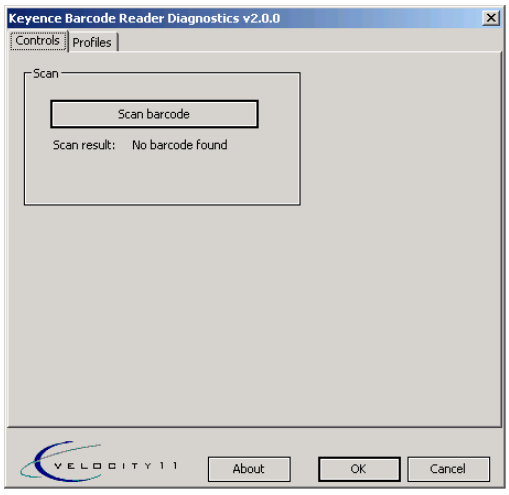
To adjust the scan angle:

1. Place the spare microplate on the Barcode Reader platepad and make sure the barcode label faces the Barcode Reader mirror.
2. Open **Keyence Barcode Reader Diagnostics.**
3. Click the **Profiles** tab.



4. Select the Barcode Reader profile.

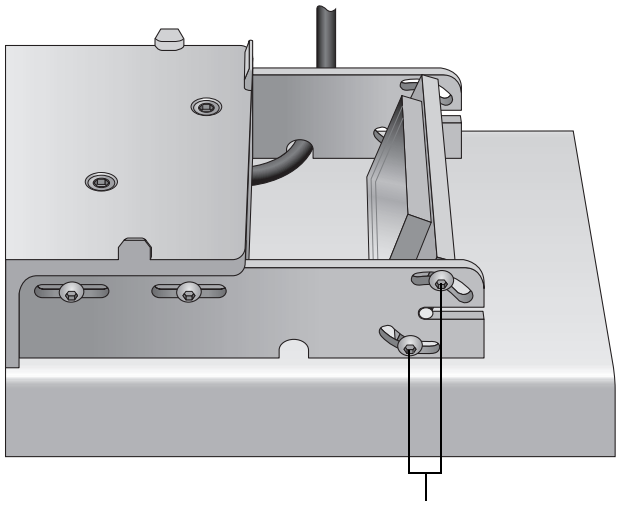
5. Click the **Controls** tab.



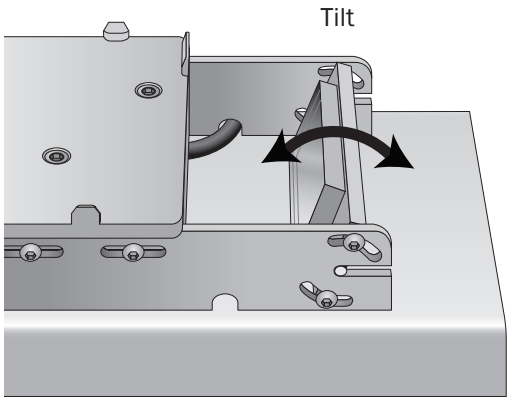
6. Click **Scan barcode.** The barcode reader laser turns on briefly to scan the barcode label. One of the following messages appears next to Scan result:

Scan result message	Description
<*barcode text*>	The barcode was successfully scanned.
No barcode found	Barcode scanning was not successful.

7. If the No barcode found message appears, click **Scan barcode** again and check that the barcode reader laser beam is projected onto the vertical center of the barcode label.
8. If the laser beam is not at the vertical center of the label, adjust the angle of the Barcode Reader mirror as follows:
   a. Loosen the screws on both sides of the Barcode Reader mirror.



b. Tilt the Barcode Reader mirror slightly. If the angle is set up properly, you can see the laser beam at the vertical center of the barcode label each time you click Scan barcode.



9. Repeat steps 6 through 8 until the reader is able to scan the barcode successfully (the barcode text appears next to Scan result).
10. Tighten the screws on both sides of the barcode reader sensor head.

Troubleshooting

If the reader is unable to scan the barcode after many adjustments, try one or more of the following:

- ❑ Make sure the bar-code label is applied properly onto the microplate.
- ❑ Make sure the microplate is sitting level on the Barcode Reader platepad.
- ❑ Make sure the barcode meets the requirements. See “Barcode label requirements” on page 17.
- ❑ Repeat the adjustment process using a new spare microplate.

Using the Barcode Reader

About this topic

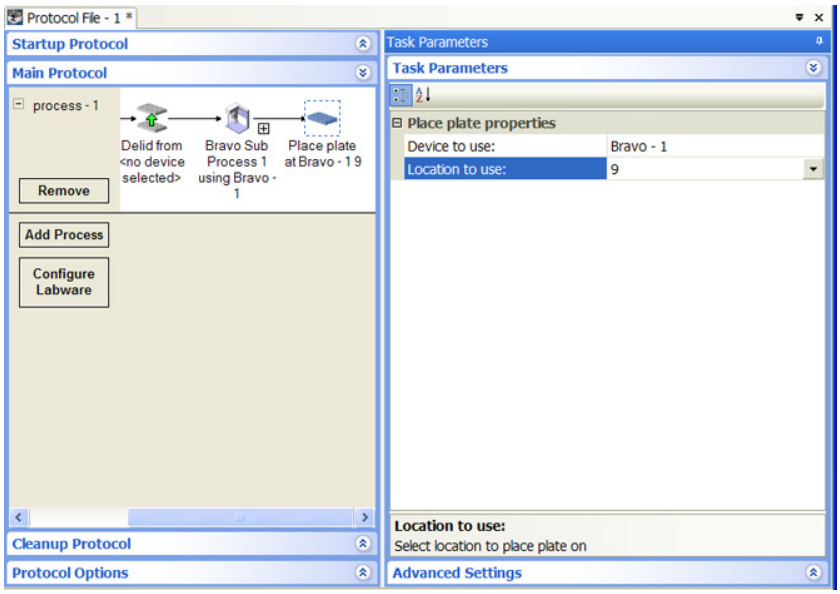
This topic explains how to use the Barcode Reader in a protocol.

!! IMPORTANT !! The Barcode Reader feature is available in VWorks Benchtop, Version 4 only.

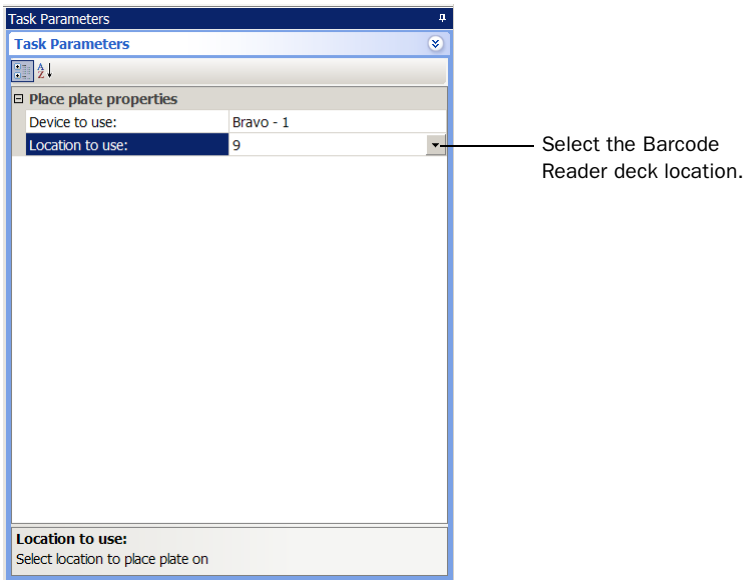
Procedure

To use the Barcode Reader in a protocol:

1. In the VWorks4 window, create a new or open an existing protocol.
2. At the desired point in the main process, add the task.
3. Select the **Place Plate** task in the main process or sub-process. The Task Parameters area displays to the right of the Protocol workspace tab.



4. In the **Place plate properties** table, select the deck location that has the Barcode Reader. During the protocol run, when a microplate is placed at the selected deck location, the Barcode Reader will scan the microplate barcode.



5. Continue to add tasks and finish creating the protocol.

Assembling the Vacuum Filtration Station during a run

This section contains the following topics:

- ❑ “Supported configurations and automation workflow” on page 28
- ❑ “Configuring the Vacuum Filtration Station” on page 30
- ❑ “Setting the automation task parameters” on page 36
- ❑ “Setting the robot gripper offset” on page 43

Supported configurations and automation workflow

About this topic

In addition to the basic Vacuum Filtration Station configuration (station base and station collar only), the Bravo Platform can support two other common configurations. Using the latest VWorks4 software, you have the option of automating the assembling and disassembling process for these two types of stations during a protocol run.

This topic describes the following:

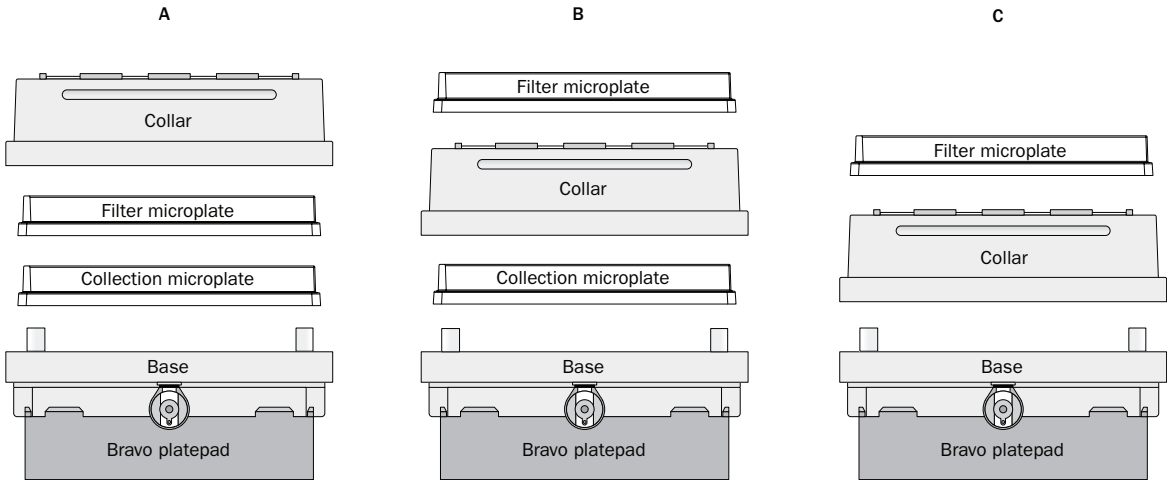
- ❑ The supported Vacuum Filtration Station configurations
- ❑ The workflow you use to automate the assembly and disassembly processes

For more information about the Vacuum Filtration Station and installation instructions, see the *Bravo User Guide*.

Supported configurations

To accommodate different assay types, the Bravo Platform supports the Vacuum Filtration Station configurations shown in the diagram. Note the following:

- ❑ *Configuration A*. The filter microplate is part of the station assembly. The assembly process can be automated during the protocol run.
- ❑ *Configuration B*. The filter microplate is not part of the station assembly. The assembly process can be automated during the protocol run. The robot will move the filter microplate to the station after the assembly process is finished.
- ❑ *Configuration C*. The basic configuration is described in the *Bravo User Guide*. The filter microplate is not part of the station assembly. The station should always be assembled before a protocol run (assembly is not automated). The robot will move the filter microplate to the station during the protocol run.



Automation workflow

The following table presents the workflow for automating the assembling and disassembling processes for Vacuum Filtration Stations that have configurations A and B.

Step	For this task...	See...
1	Configure the Vacuum Filtration Station in Bravo Diagnostics.	“Configuring the Vacuum Filtration Station” on page 30
2	Add one or more pairs of the vacuum assembly and disassembly tasks in the protocol.	“Setting the automation task parameters” on page 36
3	Set the robot gripper offset for labware that will be placed on the Vacuum Filtration Station during a protocol run.	“Setting the robot gripper offset” on page 43

Configuring the Vacuum Filtration Station

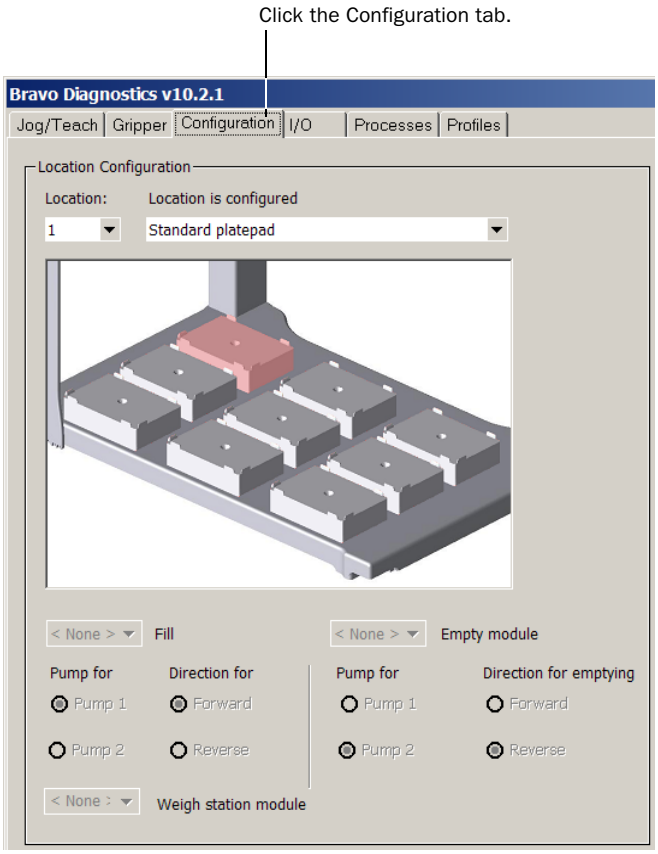
About this topic

This topic explains how to configure the Vacuum Filtration Station in Bravo Diagnostics to automate the assembling and disassembling processes.

Procedure

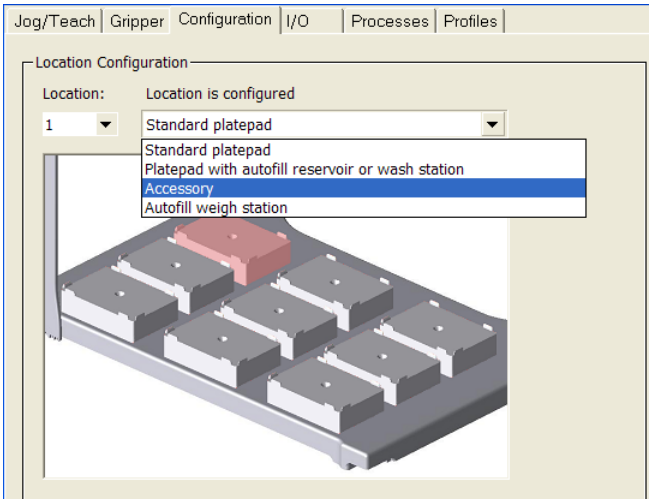
To configure the Vacuum Filtration Station in Bravo Diagnostics:

1. Open **Bravo Diagnostics.**
2. Click the **Configuration** tab.

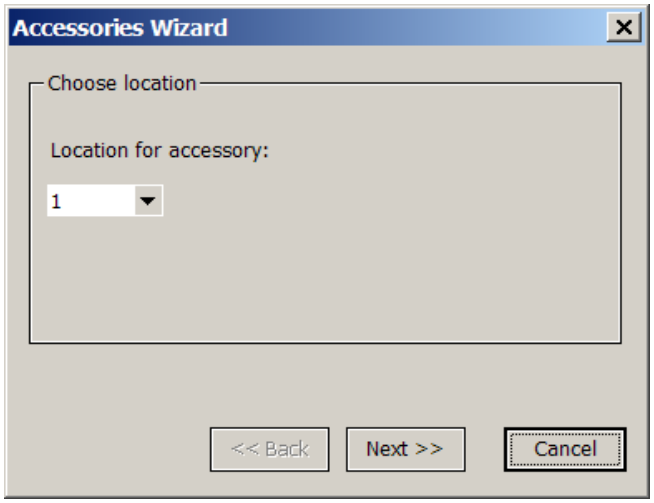


3. In the **Locations** list, select the deck location of the vacuum filtration station base.

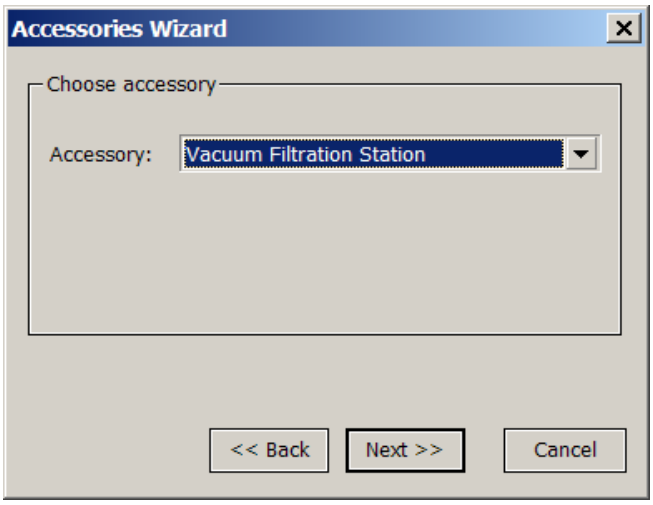
4. In the **Location is configured** list, select **Accessory.** The Accessories Wizard dialog box opens.



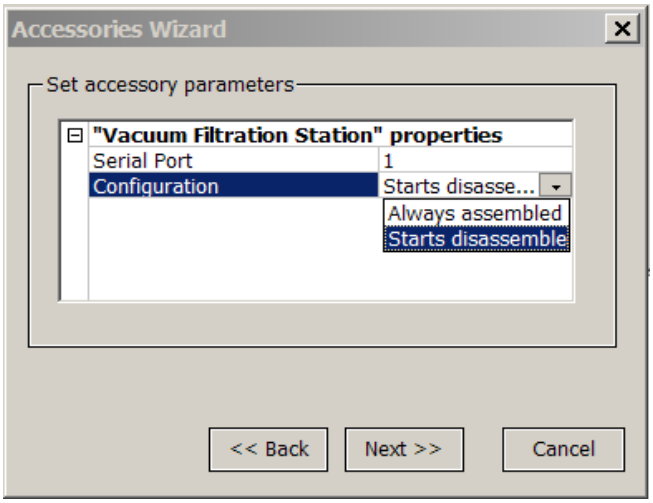
5. In the **Location** list, select or confirm the deck location of the vacuum filtration station base, and then click **Next.**



6. In the **Accessory** list, select **Vacuum Filtration Station,** and then click **Next.**



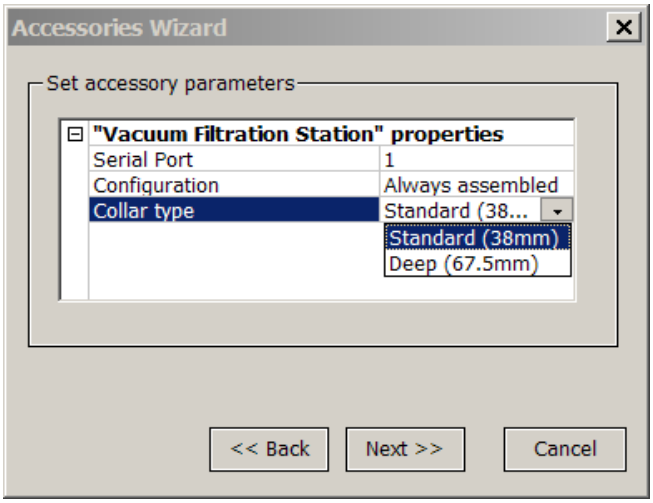
7. In the **"Vacuum Filtration Station" properties** table, set the following parameters, and then click **Next.**



Parameter	Description
Serial Port	Select the serial port (module port) that connects the pinch-valve module to the Accessories Hub. The Vacuum Filtration Station is connected to the pinch-valve module. For connection details, see the *Bravo User Guide*.

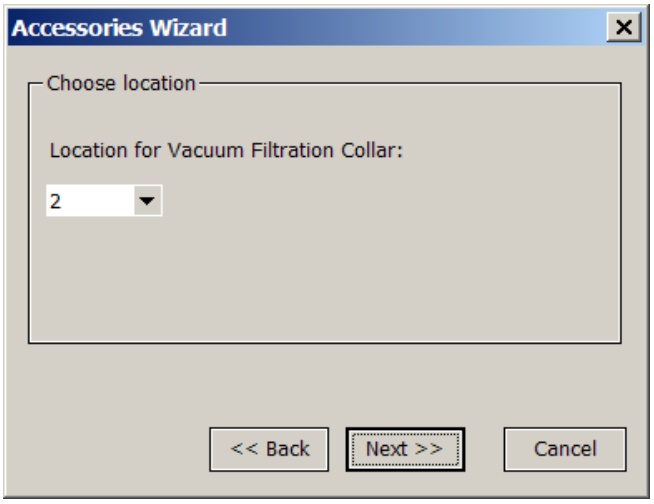
Parameter	Description
Configuration	Select Always assembled if the station is already assembled and the robot will not assemble or disassemble its components during a protocol run. *Note:* Select Always assembled if the station consists only of the base and the collar. Select Starts disassembled if the station components are at different deck locations and you want to use the Assemble Vacuum and Disassemble Vacuum tasks during a protocol run.

8. *Always assembled configuration only.* Select the **Collar type,** and then click **Next.**

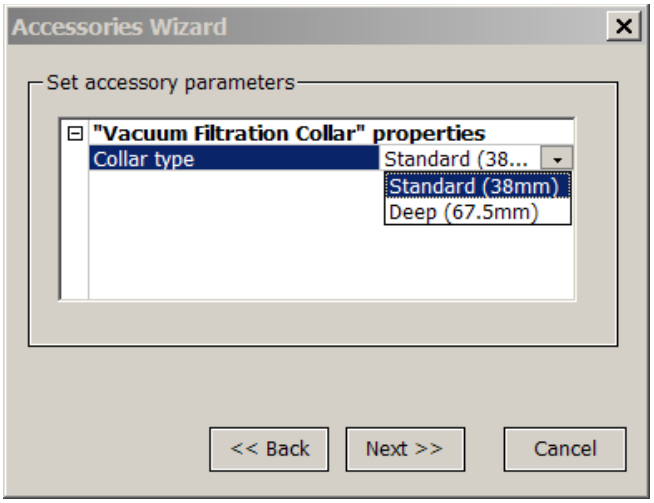


Parameter	Description
Collar type	Select Standard if you will place a manifold collar (standard collar) on the station. Select Deep if you will place a deep-well collar on the station.

9. *Starts disassembled configuration only.* In the **Location for Vacuum Filtration Collar,** select the deck location at which the collar is located, and then click **Next.**

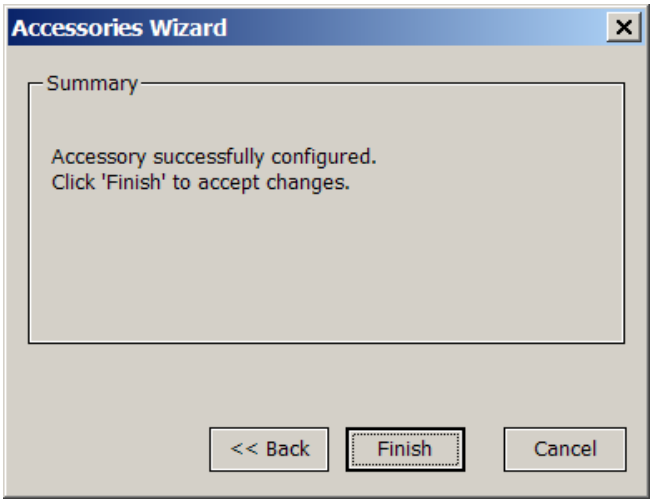


10. *Starts disassembled configuration only.* In the **"Vacuum Filtration Collar" properties** table, set the following parameter, and then click **Next.**



Parameter	Description
Collar type	Select Standard if you will place a manifold collar (standard collar) on the station. Select Deep if you will place a deep-well collar on the station.

11. In the Accessories Wizard dialog box, click **Finish.** The software finishes configuring the Vacuum Filtration Station and alerts you to check or edit the teachpoint at the new deck location.



Use the standard platepad instead of the teach plate to set the teachpoint for the Vacuum Filtration Station. For instructions on how to edit teachpoints, see the *Bravo User Guide*.

Setting the automation task parameters

About this topic

To automate the Vacuum Filtration Station assembly and disassembly processes during a run, you use the Assemble Vacuum and Disassemble Vacuum tasks in the VWorks4 software. In addition, you need to add either the Move and Filter Plate or Toggle Vacuum task to turn on and turn off the vacuum.

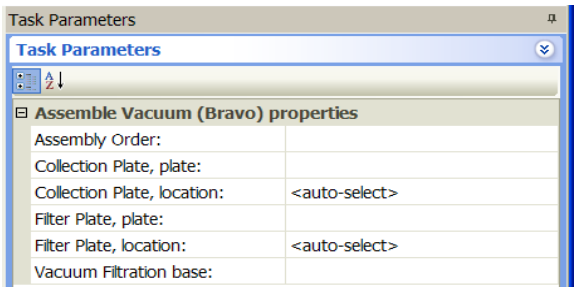
This topic explains how to add the tasks and set the associated task parameters in the VWorks4 software.

Setting the Assemble Vacuum task parameters

The Assemble Vacuum task directs the robot to pick up components from designated locations and stack them in the order you specify.

To add the Assemble Vacuum task and set the parameters:

1. In the VWorks4 software, create a new or open an existing protocol.
2. At the desired point in the Bravo Sub-Process, add the Assemble Vacuum (Bravo) task.
3. In the **Task Parameters** area, set the following parameters:



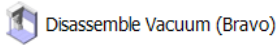
Parameter	Description
Assembly Order	The order, from bottom to top, in which you want to stack the station components. The selections are: ❑ Base–Collection plate–Filter plate–Collar ❑ Base–Collection plate–Collar
Collection Plate, plate	The type of microplate for collecting the filtrate.
Collection Plate, location	The location of the collection microplate. Select the deck location of the collection microplate. Select <auto-select> only if the software knows of the collection microplate location (for example, if you used a Place Plate task earlier in the protocol to specify its location).

Parameter	Description
Filter Plate, plate	The type of microplate used for the filtering process.
Filter Plate, location	The location of the filtering microplate. Select the deck location of the filter microplate. Select <auto-select> only if the software knows of the filter microplate location (for example, if you used a Place Plate task earlier in the protocol to specify its location).
Vacuum Filtration base	The location of the Vacuum Filtration Station base.

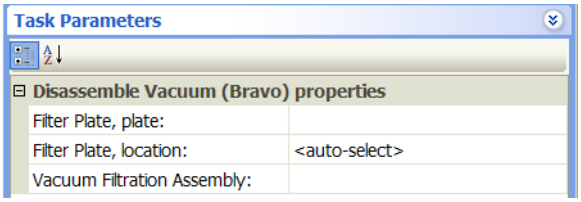
Setting the Disassemble Vacuum task parameters

The Disassemble Vacuum task directs the robot to remove components from the Vacuum Filtration Station and place them back at the locations specified in the Assemble Vacuum task (see “Setting the Assemble Vacuum task parameters” on page 36). If a filter microplate was placed on top of the station, the Disassemble Vacuum task directs the robot to move the microplate to a specified location before disassembly.

To add the Disassemble Vacuum task and set the parameters:

1. In the protocol, at the desired point in the Bravo Sub-Process, add the 

task.
2. In the **Task Parameters** area, set the following parameters:



Parameter	Description
Filter Plate, plate	The type of microplate used for the filtering process.
Filter Plate, location	The location at which you want to place the filter microplate during the disassembly process.
Vacuum Filtration Assembly	The location of the Vacuum Filtration Station.

Setting the Move and Filter Plate task parameters

The Move and Filter task:

- ❑ Moves a specified filter microplate from its current location to the Vacuum Filtration Station.
- ❑ Turns on and turns off the vacuum.

Use the Move and Filter Plate task if the Vacuum Filtration Station has configuration B, where the filter microplate is not part of the station assembly. (For a full description of the configuration, see “Supported configurations” on page 28.)

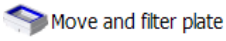
If you plan to time the filtering process, add only one Move and Filter Plate task (the task turns on the vacuum, and at the end of the time period, the vacuum turns off automatically). If you are not timing the filtering process, add two Move and Filter Plate tasks in the protocol (one to turn on the vacuum and the other to turn off the vacuum).

Note: If the filtering process is not timed, the protocol can perform other tasks in parallel.

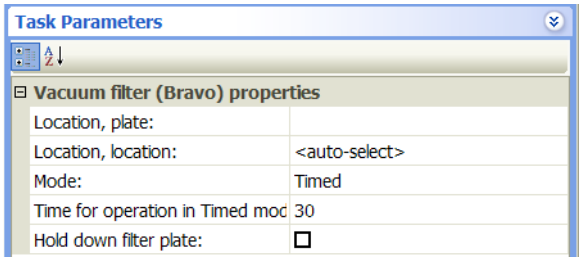
If the Vacuum Filtration Station has configuration A, where the filter microplate is part of the assembly (it sits under the collar), use the Toggle Vacuum task to turn on and turn off the vacuum. See “Setting the Toggle Vacuum task parameters” on page 39.

For an example protocol demonstrating the use of the Move and Filter Plate task, see “Example protocols” on page 40.

To add the Move and Filter Plate task and set the parameters:

1. In the protocol, at the desired point in the Bravo Sub-Process, add the 

task.
2. In the **Task Parameters** area, set the following parameters:



Parameter	Description
Location, plate	The deck location of the filter microplate. The robot will move the microplate from this location to the Vacuum Filtration Station (specified by the Location, location parameter).

Parameter	Description
Location, location	The deck location of the Vacuum Filtration Station. Select <auto-select> if you want the robot to place the filter microplate at the first-available Vacuum Filtration Station. If more than one Vacuum Filtration Station is on the deck, select the specific deck location.
Mode	The action of the task: ❑ *On*. Turns on the vacuum. ❑ *Off*. Turns off the vacuum. ❑ *Timed*. Turns on the vacuum timer. You must specify the vacuum length of time.
Time for operation in Timed mode(s)	The length of time, in seconds, you want to leave the vacuum on. At the end of the period, the vacuum will turn off.

3. If you did not specify a time period in Time for operation in Timed mode(s), add a second Move and Filter Plate task and repeat step 2.

Setting the Toggle Vacuum task parameters

The Toggle Vacuum task turns on and turns off the vacuum. Use the Toggle Vacuum task if the Vacuum Filtration Station has configuration A, where the filter microplate is part of the station assembly. (For a full description of the configuration, see “Supported configurations” on page 28.)

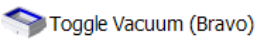
If you plan to time the filtering process, add only one Toggle Vacuum task (the task turns on the vacuum, and at the end of the time period, the vacuum turns off automatically). If you are not timing the filtering process, add two Toggle Vacuum tasks in the protocol (one to turn on the vacuum and the other to turn off the vacuum).

Note: If the filtering process is not timed, the protocol can perform other tasks in parallel.

If the Vacuum Filtration Station has the base–collection plate–collar configuration and you want the robot to move the filter microplate from another location to the station, use the Move and Filter Plate task to turn on and turn off the vacuum. See “Setting the Move and Filter Plate task parameters” on page 38.

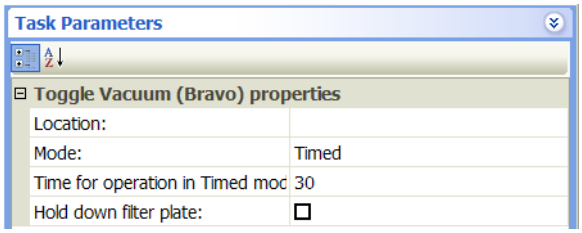
For an example protocol demonstrating the use of the Toggle Vacuum task, see “Example protocols” on page 40.

To add the Toggle Vacuum task and set the parameters:

1. In the protocol, at the desired point in the Bravo Sub-Process, add the 

task.

2. In the **Task Parameters** area, set the following parameters:



Parameter	Description
Location	The location of the Vacuum Filtration Station.
Mode	The action of the task: ❑ *On*. Turns on the vacuum. ❑ *Off*. Turns off the vacuum. ❑ *Timed*. Turns on the vacuum timer. You must specify the vacuum length of time.
Time for operation in Timed mode(s)	The length of time, in seconds, you want to leave the vacuum on. At the end of the period, the vacuum will turn off.
Hold down filter plate	The option to have the robot hold down the filter microplate when the vacuum is turned on to ensure a secure vacuum seal.

3. If you did not specify a time period in Time for operation in Timed mode(s), add a second Toggle Vacuum task and repeat step 2.

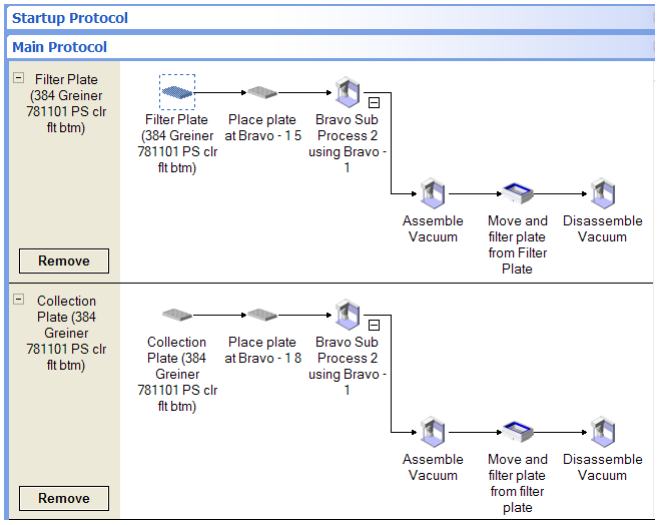
Example protocols

Example protocol using the Move and Filter Plate task

The following example protocol demonstrates the use of the Assemble Vacuum, Disassemble Vacuum, and Move and Filter Plate tasks. The Move and Filter Plate task should be used when the Vacuum Filtration Station has the base–collection plate–collar configuration (the filter microplate does not sit under the collar).

The example protocol uses the following information from the device file and task parameter settings (not shown):

- ❑ The Vacuum Filtration Station will be assembled at deck location 3.
- ❑ The Vacuum Filtration Station base is at deck location 3.
- ❑ The collar is at deck location 9.
- ❑ The vacuum will be timed for 30 seconds.
- ❑ During the disassembly process, the filter microplate will be placed at the first-available deck location.


Startup Protocol
Main Protocol
Filter Plate (384 Greiner 781101 PS clr flt btm)
Remove
Filter Plate (384 Greiner 781101 PS clr flt btm)
Place plate at Bravo - 1 5
Bravo Sub Process 2 using Bravo - 1
Assemble Vacuum
Move and filter plate from Filter Plate
Disassemble Vacuum
Collection Plate (384 Greiner 781101 PS clr flt btm)
Remove
Collection Plate (384 Greiner 781101 PS clr flt btm)
Place plate at Bravo - 1 8
Bravo Sub Process 2 using Bravo - 1
Assemble Vacuum
Move and filter plate from filter plate
Disassemble Vacuum

The protocol will perform the following tasks:

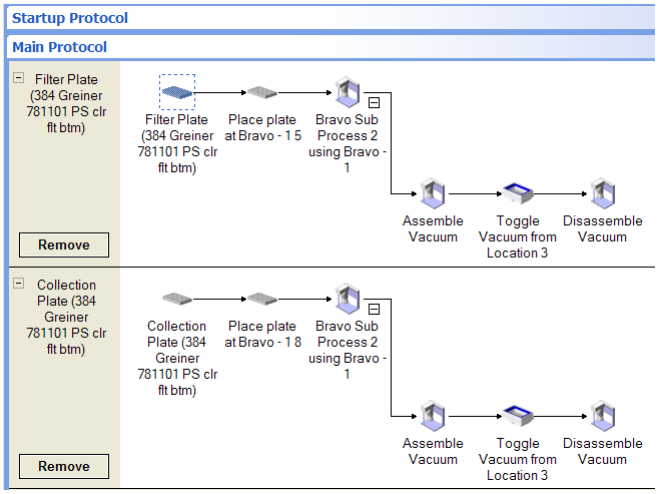
1. Acknowledge that the filter microplate (Filter Plate) is starting at deck location 5.
2. Acknowledge that the collection microplate (Collection Plate) is starting at deck location 8.
3. Assemble the Vacuum Filtration Station (base–collection plate–collar):
    a. Move the Collection Plate from deck location 8 and place it on top of the base at deck location 3.
    b. Move the collar from deck location 9 and place it on top of the Collection Plate at deck location 3.
4. Move the Filter Plate from deck location 5 and place it on top of the assembled Vacuum Filtration Station at deck location 3.
5. Turn on the vacuum for 30 seconds, and then turned off the vacuum.
6. Disassemble the Vacuum Filtration Station:
    a. Move the Filter Plate to an available deck location.
    b. Move the collar back to deck location 9.
    c. Move the Collection Plate back to deck location 8.

Example protocol using the Toggle Vacuum task

The following example protocol demonstrates the use of the Assemble Vacuum, Disassemble Vacuum, and Toggle Vacuum tasks. The Toggle Vacuum task should be used when the Vacuum Filtration Station has the base–collection plate–filter plate–collar configuration (the filter microplate sits under the collar).

The example protocol uses the following information from the device file and task parameter settings (not shown):

- ❑ The Vacuum Filtration Station will be assembled at deck location 3.
- ❑ The Vacuum Filtration Station base is at deck location 3.
- ❑ The collar is at deck location 9.
- ❑ The vacuum will be timed for 30 seconds.


Startup Protocol
Main Protocol
Filter Plate (384 Greiner 781101 PS clr flt btm)
Remove
Filter Plate (384 Greiner 781101 PS clr flt btm)
Place plate at Bravo - 1 5
Bravo Sub Process 2 using Bravo - 1
Assemble Vacuum
Toggle Vacuum from Location 3
Disassemble Vacuum
Collection Plate (384 Greiner 781101 PS clr flt btm)
Remove
Collection Plate (384 Greiner 781101 PS clr flt btm)
Place plate at Bravo - 1 8
Bravo Sub Process 2 using Bravo - 1
Assemble Vacuum
Toggle Vacuum from Location 3
Disassemble Vacuum

The protocol will perform the following tasks:

1. Acknowledge that the filter microplate (Filter Plate) is starting at deck location 5.
2. Acknowledge that the collection microplate (Collection Plate) is starting at deck location 8.
3. Assemble the Vacuum Filtration Station (base–collection plate–filter plate–collar):
   a. Move the Collection Plate from deck location 8 and place it on top of the base at deck location 3.
   b. Move the Filter Plate from deck location 5 and place it on top of the Collection Plate at deck location 3.
   c. Move the collar from deck location 9 and place it on top of the Filter Plate at deck location 3.
4. Turn on the vacuum for 30 seconds, and then turn off the vacuum.
5. Disassemble the Vacuum Filtration Station:
   a. Move the collar back to deck location 9.
   b. Move the Filter Plate back to deck location 5.
   c. Move the Collection Plate back to deck location 8.

Setting the robot gripper offset

About this topic

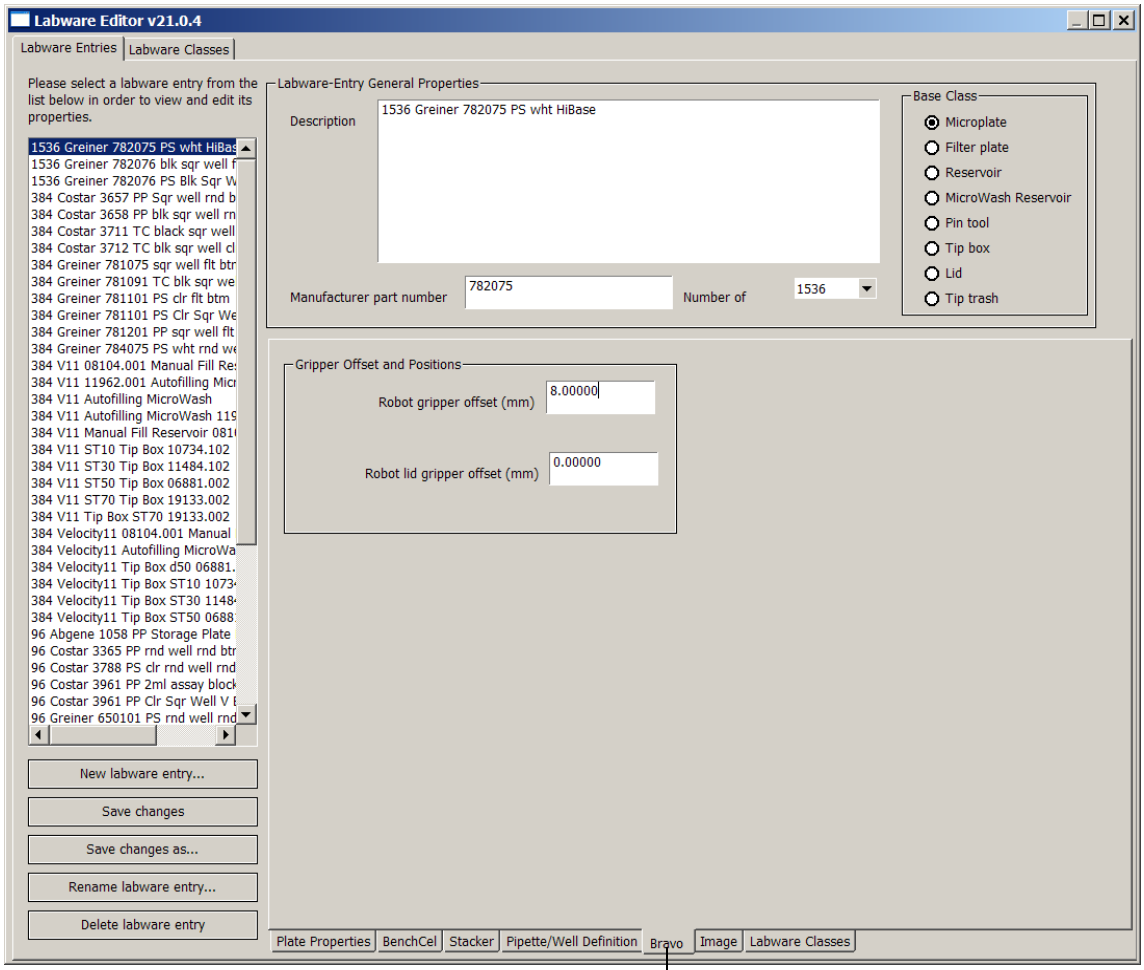
So that microplates are placed properly on the Vacuum Filtration Station, the Bravo robot gripper must hold the microplates 8 mm or higher from the bottom of the microplate. You use the Robot gripper offset parameter in the Labware Editor to specify this height.

This topic explains how to specify the microplate-holding height.

Procedure

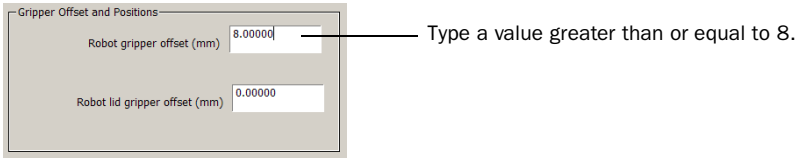
To specify the microplate-holding height:

1. Open the **Labware Editor.** See the *VWorks4 User Guide* for instructions.
2. Click the **Bravo** tab.



Click the Bravo tab.

3. In the **Gripper Offset and Positions** area, type 8 (or a greater value) in the Robot gripper offset box.


Gripper Offset and Positions
Robot gripper offset (mm)
8.00000
Robot lid gripper offset (mm)
0.00000
Type a value greater than or equal to 8.

4. Click **Save Changes.**

User Guide revisions

This section presents revisions to the *Bravo User Guide*, July 2006 edition. This section contains the following topics:

- ❑ “Setting teachpoints” on page 46
- ❑ “Editing teachpoints” on page 50
- ❑ “Accessories” on page 51

Setting teachpoints

About this topic

This topic replaces the editing teachpoints instructions in the *Bravo User Guide*.

This topic explains how to set teachpoints. You might need to set teachpoints if:

- ❑ You are using a new pipette head for the first time on the Bravo.
- ❑ The existing teachpoint files are lost or damaged.

Before you start

Make sure you do the following:

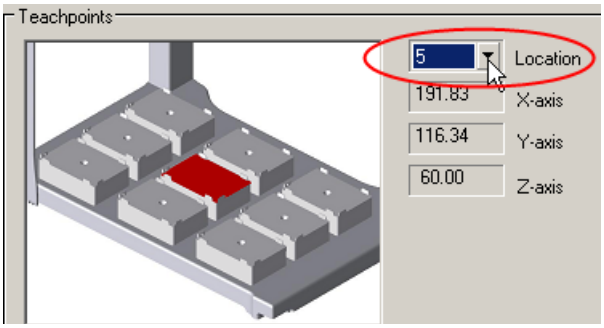
- ❑ Remove all labware from the Bravo deck locations.
- ❑ For a pipette head unknown to the Bravo:
  - ◆ Install the pipette head.
  - ◆ Create a new profile for the pipette head. For instructions, see the *Bravo User Guide*.

Setting the first teachpoint

To set the first teachpoint:

1. In the VWorks4 window, open **Bravo Diagnostics.**
2. In the **Profiles** tab, select the desired profile. For example, select the profile you created for the new pipette head.
3. Click the **Jog/Teach** tab.
4. If you are using a pipette head with disposable tips, place a tip firmly on the head's barrel that corresponds to the A1 well of the labware you are using.

   Make sure the disposable tip is a Velocity11 tip and is the same type that you specified in the **Default tip type** field of the head's profile.
5. If you are using a fixed-tip head, set the teachpoint according to the A1 needle of the pipette head.
6. In the **Jog/Teach** tab, select location 5 from the **Location** list and click **Approach.**



7. Visually check the position of the pipette tip.

   It should be directly above the teachpoint (indicated by crosshairs on the A1 corner of the platepad) by the **Approach height** set in Bravo diagnostics (**Jog/Teach** tab).

8. Use the **Jog Axes** commands to move the pipette head to the correct teachpoint:

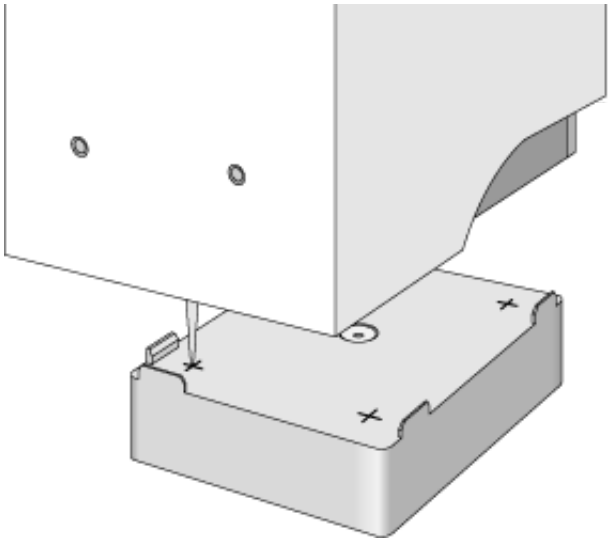
   a. Jog the pipette head down (*z*-axis) until it is approximately 2 mm above the platepad.

      Reduce the increment value when the tip gets close to the deck.

      !! DAMAGE HAZARD !! Especially for a fixed tip head, be careful not to jog down too far. Jogging down too far will damage the tip.

   b. Jog the pipette head in 0.05 mm increments in the *x* and *y* directions, targeting the crosshairs.

   c. Jog the pipette head in 0.05 mm increments in the *z* direction until the tip clears the platepad by about the thickness of a sheet of paper.



9. When the tip is in the correct position (directly over the crosshairs with paper-thin clearance), click **Teach.**

   Verify the information in the message box before you click **OK.**

10. To save the teachpoint, click the **Profiles** tab and click **Update this profile.**

Refining the teachpoint

If the pipette head uses disposable-tips, you can refine the teachpoint as follows:

1. In **Bravo Diagnostics,** in the **Jog/Teach** tab, click **Move to safe height at current X/Y position** to move the head up so that you have enough room to remove the single pipette tip from the head.
2. Place an entire box of pipette tips on deck location 5. Make sure the box is sitting level on the deck location.
3. In **Bravo Diagnostics,** click the **Processes** tab.
4. In the **Command Parameters** area, select **Tips On** from the **Command to Execute** list.
5. Click **Execute Command.** The pipette head presses down to install the tips, and then moves back up.
6. Remove the empty pipette tip box from deck location 5.
7. In the **Jog/Teach** tab, click **Move.** The pipette head moves to the teachpoint you set in “Setting the first teachpoint” on page 46. You might notice that the A1 tip is not quite in the correct position.
8. Use the **Jog Axes** commands to move the pipette head to the correct position (directly over the crosshairs with paper-thin clearance).
9. When you are finished, click **Teach**.

   Verify the information in the message box before you click **OK**.
10. To save the teachpoint, click the **Profiles** tab and click **Update this profile**.

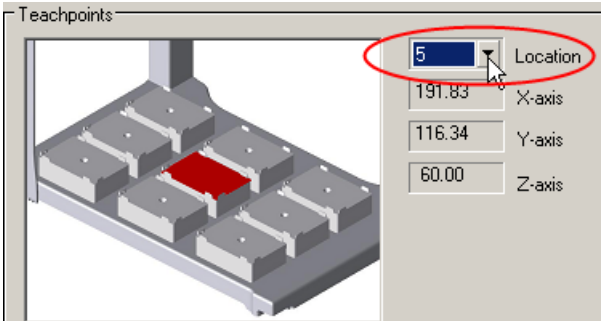
Setting other teachpoints based on one teachpoint

After setting a single teachpoint as described in the previous subtopics, you can have VWorks calculate the other eight teachpoints based on the selected teachpoint. Typically, this is done upon initial set up of a new head.

!! IMPORTANT !! For optimal performance, teach each of the nine locations independently.

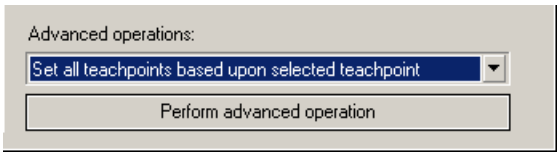
To set the other eight teachpoints:

1. In the **Jog/Teach** tab, make sure that the teachpoint you just taught (in the preceding topic) is set in the **Location** list.



The teachpoint for the other locations will be set based on this one.

2. In the **Advanced operations** area of the **Jog/Teach** tab, select **Set all teachpoints based upon selected teachpoint**.



3. Click **Perform advanced operation.**

   VWorks calculates the teachpoints for the other eight locations, keeping the *z*-axis coordinate the same and changing the *x* and *y* coordinates according to their spacing.

4. To save the teachpoints, click the **Profiles** tab and click **Update this profile.**

Setting teachpoints for accessory locations

To set teachpoints for the Bravo accessories, follow the instructions in the *Bravo User Guide*.

!! IMPORTANT !! When setting teachpoints for the Orbital Shaking Station, you will need to use a teach plate. For instructions, see the next subtopic.

Using the teach plate

The teach plate is 10 mm thick. When editing the teachpoint for the Orbital Shaking Station, you need to account for this height before setting the teachpoint.

To edit a teachpoint using the teach plate:

1. Place the teach plate on the Orbital Shaking Station.
2. Move or jog the pipette head so that the pipette tip is in the correct position (directly over the crosshairs with paper-thin clearance).
3. Jog the head up so that you have enough room to remove the teach plate. Remember the distance you jogged up.
4. Remove the teach plate.
5. Jog the pipette head down the same distance in step 3.
6. Jog the pipette head down 10 mm to account for the platepad thickness.
7. Set the teachpoint in Bravo Diagnostics.

Verifying teachpoints

Follow the instructions in the *Bravo User Guide*.

Editing teachpoints

About this topic

This topic explains how to edit existing teachpoints.

Procedure

To edit a teachpoint:

1. Follow the instructions in “Setting the first teachpoint” on page 46. However, make sure you select the desired deck location.
2. Verify the revised teachpoint. See the *Bravo User Guide* for the verification procedure.

Accessories

About this topic

This topic presents added or revised information about the Bravo accessories.

MicroWash Reservoir

Two types of MicroWash Reservoirs are available: the 96-well and the 384-well. You can use either reservoir type with any of the Velocity11 96-channel pipette heads. However, the Velocity11 384-channel pipette head is limited to the 384-well reservoir. In all cases, make sure the pipette tips do not touch the bottom of the reservoirs. To adjust the distance from the bottom, you can use the Bravo pipetting task parameters in the VWorks4 software. For instructions, see the *VWorks4 User Guide*.

Configuring the Weigh Station

The Weigh Station is an electronic scale that measures the weight of the Auto Filling Reservoir to ensure that it is always filled. The Weigh Station looks like a platepad and should be installed under the Auto Filling Reservoir at deck locations 1, 2, or 3.

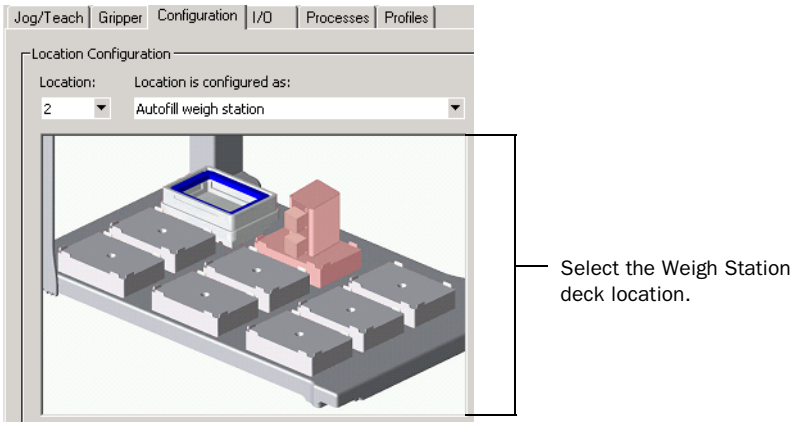
You must configure the Weigh Station before use. When you configure the Weigh Station, you are calibrating it for the reservoir that will be weighed.

To configure the Weigh Station:

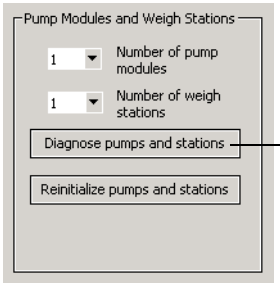
1. Open **Bravo Diagnostics.**
2. Click the **Configuration** tab.
3. In the graphic display area, select the deck location on which you installed the Weigh Station. The deck location is highlighted.

   Note: The Weigh Station is represented by a Pump Module graphic in the software.

   In the following example, the Weigh Station is installed at deck location 2, as shown by the Pump Module graphic.

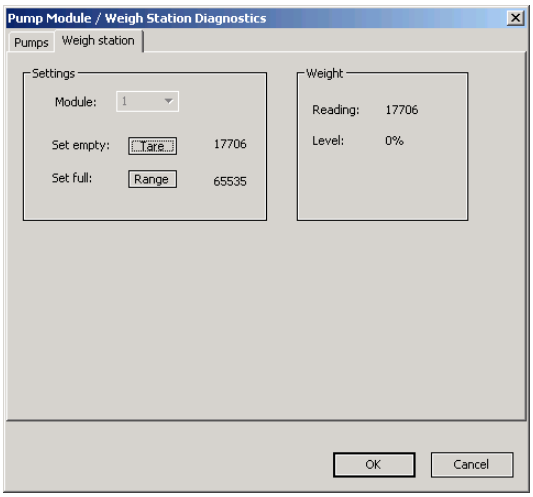


4. In the **Pump Modules and Weigh Stations** area, click **Diagnose pumps and stations.**



Click to open the Pump Module/ Weigh Station Diagnostics dialog box.

The Pump Module/Weigh Station Diagnostics dialog box opens.

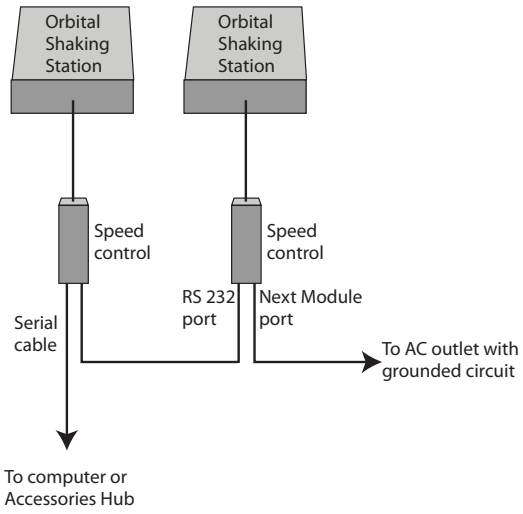


5. If you have installed more than one Pump Module, select the module number in the **Module** list.
6. Place the Auto Filling Reservoir on the Weigh Station. Make sure the reservoir is empty.
7. Click **Tare** to set the Level to 0% (empty).
8. Fill the reservoir to the desired fill level.
9. Click **Range** to set the Level to 100% (full).
10. If you have not already done so, follow the instructions in the *Bravo User Guide* to assign the Weigh Station to a deck location.

    Note: In the **Configuration** tab, in the **Location is configured** list, the selection for the Weigh Station is **Autofill weigh station.**

Connecting multiple Orbital Shaking Stations

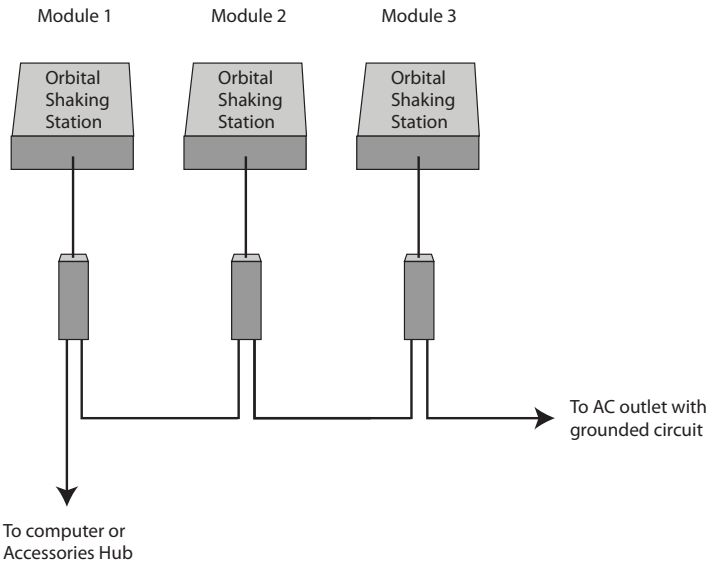
You can connect multiple Orbital Shaking Stations serially to the Bravo. The following diagram shows how to connect the stations.



To configure an Orbital Shaking Station:

1. Open **Bravo Diagnostics.**
2. Click the **Configuration** tab.
3. In the **Location is configured** list, select **Accessory.** The Accessories Wizard dialog box opens.
4. Follow the instructions in the **Accessories Wizard** dialog box to:
   - Specify the **Location** on which you have installed the Orbital Shaking Station. Your selection in this dialog box overrides the default selection in the Configuration tab.
   - Select the **Orbital Shaking Station** accessory to indicate that you have installed an Orbital Shaking Station.
   - Select the controlling computer **Serial Port** that connects to the Orbital Shaking Station.

- Select the **Module number** that indicates the position of the Orbital Shaking Station you are configuring. Select 1 for the station that is connected directly to the controlling computer or Accessories Hub. Select 2 for the station that is connected to the first station, and so on.



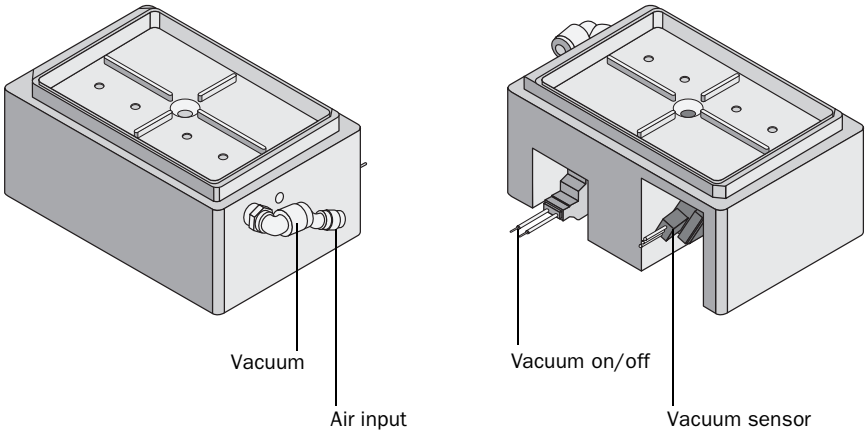
5. Click **Finish** when you are finished configuring the Orbital Shaking Station.

Installing the Microplate Vacuum Alignment Station

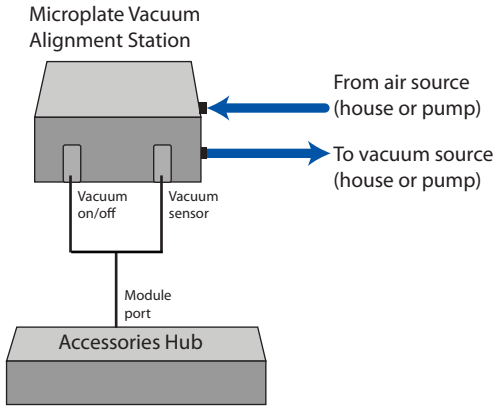
The Microplate Vacuum Alignment Station has the following air and vacuum requirements:

Requirement	Value
Compressed air supply	Quality: Clean, compressed, oil-free Source: House, cylinder, or portable pump Flow rate: 28 Lpm (1.0 cfm) Pressure: 0.55 MPa (80 psi) *Note:* Compressed air is used to actuate the vacuum valve.
Vacuum	Flow rate: 18 Lpm (0.65 cfm) Vacuum: 0.2 MPa or greater (6 in Hg or greater) *Note:* Vacuum is used to hold microplates that tend to warp.

The following diagram shows the air-input and vacuum connections on the right and back sides of the Microplate Vacuum Alignment Station.



The following diagram shows the Microplate Vacuum Alignment Station connections to the Accessories Hub. Note that a Y-splitter cable connects the vacuum on/off and vacuum sensor to a single Accessories Hub module port. Be sure to edit the teachpoint after installation.



Bravo User Guide

July 2006

VWorks4 version 2

16968.01.00.00_BravoUG_Jul06

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Introduction

1

This chapter introduces the *Bravo User Guide*.

Before operating the Bravo, become familiar with the operating procedures in this guide.

This chapter contains the following topics:

❑ "Who should read this guide" on page 2
❑ "About Velocity11 user guides" on page 3
❑ "What this guide covers" on page 6
❑ "What's new in this version" on page 6
❑ "Reporting Bravo problems" on page 7
❑ "Safety information about the Bravo" on page 8

Who should read this guide

Job roles

This user guide is for people with the following job roles:

Job role	Responsibilities
Installer	Someone who unpacks, puts together, and tests the Bravo before it is used.
Lab manager, administrator, or technician	Someone who is responsible for: ❑ Managing the Bravo ❑ Developing the applications that are run on it ❑ Solving the more challenging problems that might arise ❑ Developing training materials and standard operating procedures for operators
Operator	Someone who performs the daily production work using the Bravo and solves routine problems. Your organization may choose to create its own procedures for operators including the procedures in this guide.

About Velocity11 user guides

About this topic

This topic describes the different formats of Velocity11 documentation.

Each Velocity11 user guide is delivered to you as:

- ❑ Online help
- ❑ A PDF file
- ❑ A printed book

The information in each format is the same but each format has different benefits.

Where to find the user guides

Online help

The online help is added to your computer with the software installation.

Velocity11 website

You can download the latest version of any PDF file from our website at www.velocity11.com/techdocs/docdownloadpage.html.

All Velocity11 user documentation can be searched from the website at www.velocity11.com/support/support.html.

Online help

The online help is the best format to use when you are working at the computer and when you want to perform fast or advanced searches for information.

To open the online help:

1. In VWorks do one of the following:
   - ◆ Select **Help** > **VWorks Help**.
   - ◆ Click the help button on the toolbar.

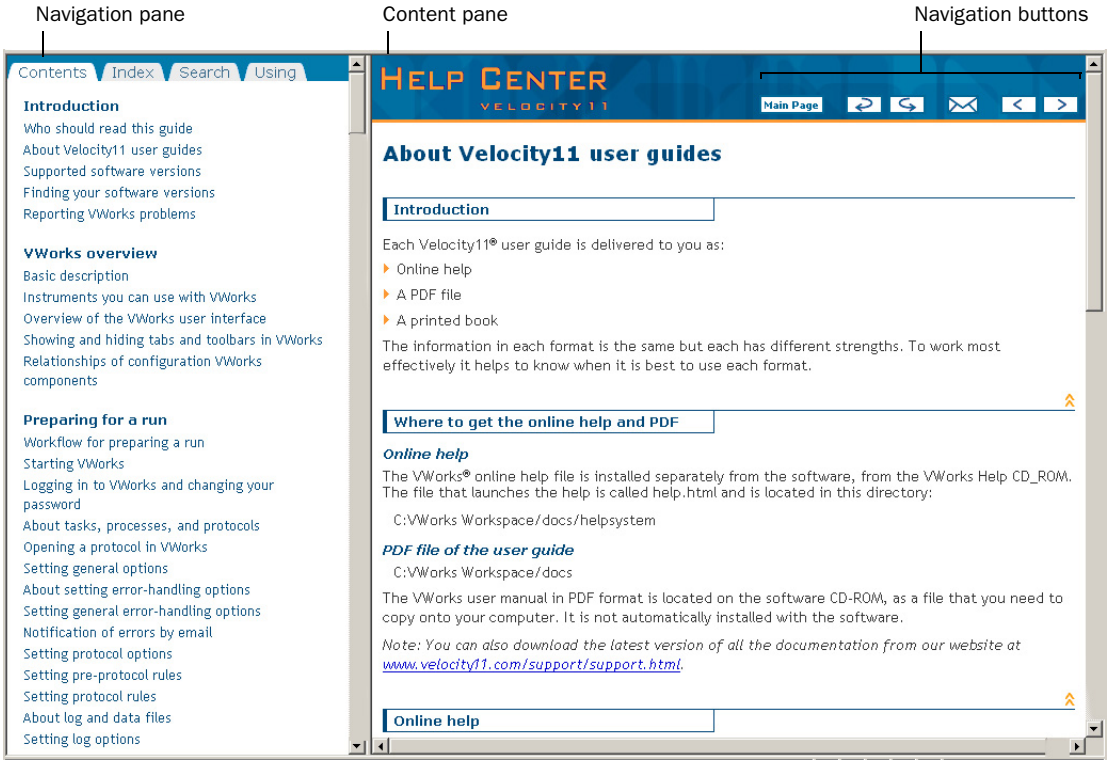
   - ◆ Press F1.

   The VWorks help opens.
2. To open the help for Bravo, click the link.
3. If you are not currently in VWorks, you can open the help by navigating to it, for example, in:

   C:\Program Files\Velocity11\VWorks4\HelpSystem\Bravo_ug\help.html.

Main features

The online help includes a navigation pane, content pane, and navigation buttons.


Navigation pane
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Showing and hiding tabs and toolbars in VWorks
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Logging in to VWorks and changing your password
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Setting general options
About setting error-handling options
Setting general error-handling options
Notification of errors by email
Setting protocol options
Setting pre-protocol rules
Setting protocol rules
About log and data files
Setting log options
HELP CENTER
VELOCITY11
Main Page
About Velocity11 user guides
Introduction
Each Velocity11® user guide is delivered to you as:
Online help
A PDF file
A printed book
The information in each format is the same but each has different strengths. To work most effectively it helps to know when it is best to use each format.
Where to get the online help and PDF
Online help
The VWorks® online help file is installed separately from the software, from the VWorks Help CD_ROM. The file that launches the help is called help.html and is located in this directory:
C:\VWorks Workspace/docs/helpsystem
PDF file of the user guide
C:\VWorks Workspace/docs
The VWorks user manual in PDF format is located on the software CD-ROM, as a file that you need to copy onto your computer. It is not automatically installed with the software.
Note: You can also download the latest version of all the documentation from our website at www.velocity11.com/support/support.html.
Online help

The navigation pane has four tabs. The Contents, Index, and Search tabs provide different ways to locate information. The Using tab contains information about using the help system.

The content pane displays the online help topics.

Navigation buttons in the content pane allow you to navigate through the pages.

PDF user guides

Computer requirements

To open a user guide in PDF format, you need an Acrobat viewer. You can either use the viewer that is built into Adobe Acrobat, or you can download the free Adobe Reader application from http://www.adobe.com/support/downloads/main.html.

Printing and searching

We provide user guides in PDF format mainly for printing additional copies. You can use them for simple searches from the Find button, although these searches are much slower than online help searches:

More information

For more information about using PDF documents, see the Adobe Acrobat PDF help system that can be accessed from your Acrobat viewer.

Related topics

For information about...	See...
Who this guide is for	“Who should read this guide” on page 2
What this guide covers	“What this guide covers” on page 6

What this guide covers

What is covered

This guide covers the installation, setup, and operation of the Bravo as a single device controlled by a computer.

Hardware version

This guide covers hardware for the Bravo. This includes accessories such as the Pump Module and MicroWash Reservoir, and the gripper arm.

Firmware version

This guide documents the firmware version 0.0.22 or later.

Related guides

For instructions on how to use VWorks 4 to control the Bravo, see the *VWorks 4 User Guide*.

For instructions on how to set the Bravo task parameters, see the *Device Driver User Guide*.

What's new in this version

About this topic

This topic lists the new Bravo features that are covered in this guide.

New features

Feature	Description	See...
Bravo gripper	New component that automates plate pickup and placement	"Bravo orientation" on page 11
Bravo accessories	Newly supported devices	"Bravo accessories" on page 109
Bravo Diagnostics	New functions that support the gripper and the new accessories	"Using Bravo Diagnostics" on page 81

Note: VWorks instructions that were in the previous version of this guide are moved to the *VWorks User Guide*.

Reporting Bravo problems

About this topic

If you have a technical or hardware problem that you cannot resolve after reading the chapter on maintenance and troubleshooting, read the information in this topic for how to report problems.

Reporting hardware problems

If you have a problem with a hardware component of the Bravo that you cannot resolve, let us know by:

- ❑ Sending an email to service@velocity11.com or euroservice@velocity11.com
- ❑ Calling Velocity11 Technical Support at 1.800.979.4811 or +1.650.846.6611

Reporting user guide problems

If you find a problem with this user guide or have suggestions for improvement, please use the feedback button in the online help. Your comments will be reviewed promptly and used to write the next version of the guide.

You can also send an email directly to documentation@velocity11.com.

Safety information about the Bravo

Introduction

This topic gives general information about the Bravo safety hazards.

Before using the Bravo

Before using a Bravo, your organization should make sure that you are properly trained in:

- ❑ General laboratory safety
- ❑ The correct and safe operation of the Bravo
- ❑ The correct and safe operation of other lab automation systems or components used in combination with the Bravo

If you are the person in your organization responsible for training others on the Bravo and you have a safety question, please contact Velocity11 Technical Support.

Safety labels

Pay attention to any safety labels printed on your Bravo. A safety label, shown below, consists of a warning symbol. A description of the warning and information that will help you to avoid the safety hazard are located in the general hazard warning section of the user guide.

Chemical hazards

Some chemicals used when working with the Bravo might be hazardous. Make sure you follow the recommendations in the MSDS (Material Safety Data Sheet) for every chemical that you plan to use. The manufacturer of the chemical should provide you with the MSDS.

Waste disposal

Remember to dispose of chemicals in compliance with all applicable regulations.

Product use

Velocity11's products must only be used in the manner in which we intend, as described in our user guides. Any other use might damage the product or injure you. Velocity11 is not responsible for damages caused, in whole or part, by unauthorized modifications, or by procedures that are not explicitly described in our user guides. Any modifications or changes to products not expressly approved in Velocity11 user guides could void the warranty.

Moving parts injury hazard

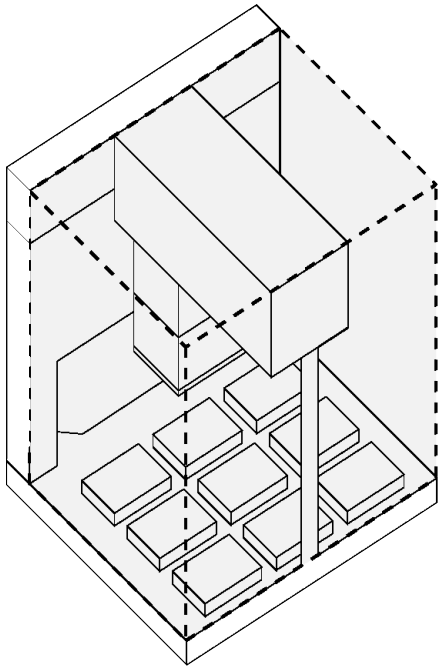
!! INJURY HAZARD !! The Bravo has moving parts that can injure you if you deviate from the procedures given in this guide. Moving parts have the following warning symbol next to them.

!! INJURY HAZARD !! Keep your fingers, hair, clothing, and jewelry away from the Bravo while it is in motion.

Not all circumstances can be foreseen and more serious injury is possible. It is the responsibility of every operator to follow warnings and safety labels and keep away from the instrument whenever it is likely to move.

!! INJURY HAZARD !! Do not initialize the Bravo while touching it. Automatic motion begins when the device is initialized.

!! INJURY HAZARD !! Never touch any of the moving parts or attempt to remove or add labware while the Bravo is in operation. There are several places on the Bravo that could pinch, pierce, or bruise you.



Shaded area indicates pinch point hazard

!! INJURY HAZARD !! Operating the Bravo without safety guards or a light curtain connected to the safety interlock circuit increases the risk of injury.

The Bravo has a safety interlock circuit that must be closed for the system to operate. A jumper can be used to close the safety interlock circuit, but the European directives regarding the safe operation of machinery require that you always connect the safety interlock to a safety guard, Light Curtain, or enclosure.

Improper cleaning hazard

!! DAMAGE HAZARD !! Do not use any abrasives, corrosive cleaning agents, or metal brushes to clean any Bravo component or accessory.

Unpacking the Bravo

!! DAMAGE HAZARD !! Read and follow all unpacking information before installation and use.

Bravo orientation

2

This chapter gives you an overview of the Bravo and contains the following topics:

- ❑ "About the Bravo" on page 12
- ❑ "Hardware overview" on page 13
- ❑ "Indicator lights" on page 17
- ❑ "The Bravo pipette heads" on page 18
- ❑ "Connection panel description" on page 21
- ❑ "Software overview" on page 23

About the Bravo

About this topic

This topic introduces the Bravo with a brief description of the device and how it is meant to be used.

Product description

The Bravo is a versatile liquid handler with a nine plate-location platform suitable for handling 96-well, 384-well, and 1536-well microplates (plates). The Bravo is controlled by VWorks, the automation software. Fitted with a choice of seven interchangeable fixed-tip or disposable-tip pipette heads, it accurately dispenses fluids from 0.1 µL to 200 µL.

Ways to use the Bravo

The Bravo can be used in the following ways:

- ❑ As a single device controlled by a computer
- ❑ Integrated with other devices in a lab automation system

For example, when used as a single device, it can be placed in a laminar flow hood for use with cell-based applications or handling potentially hazardous materials.

As an integrated device in a lab automation system, it can be used to prepare plates for high-throughput screening or other automated process. Note that when used with other devices, you can take advantage of the gripper feature to automate plate pickup and placement.

Hardware overview

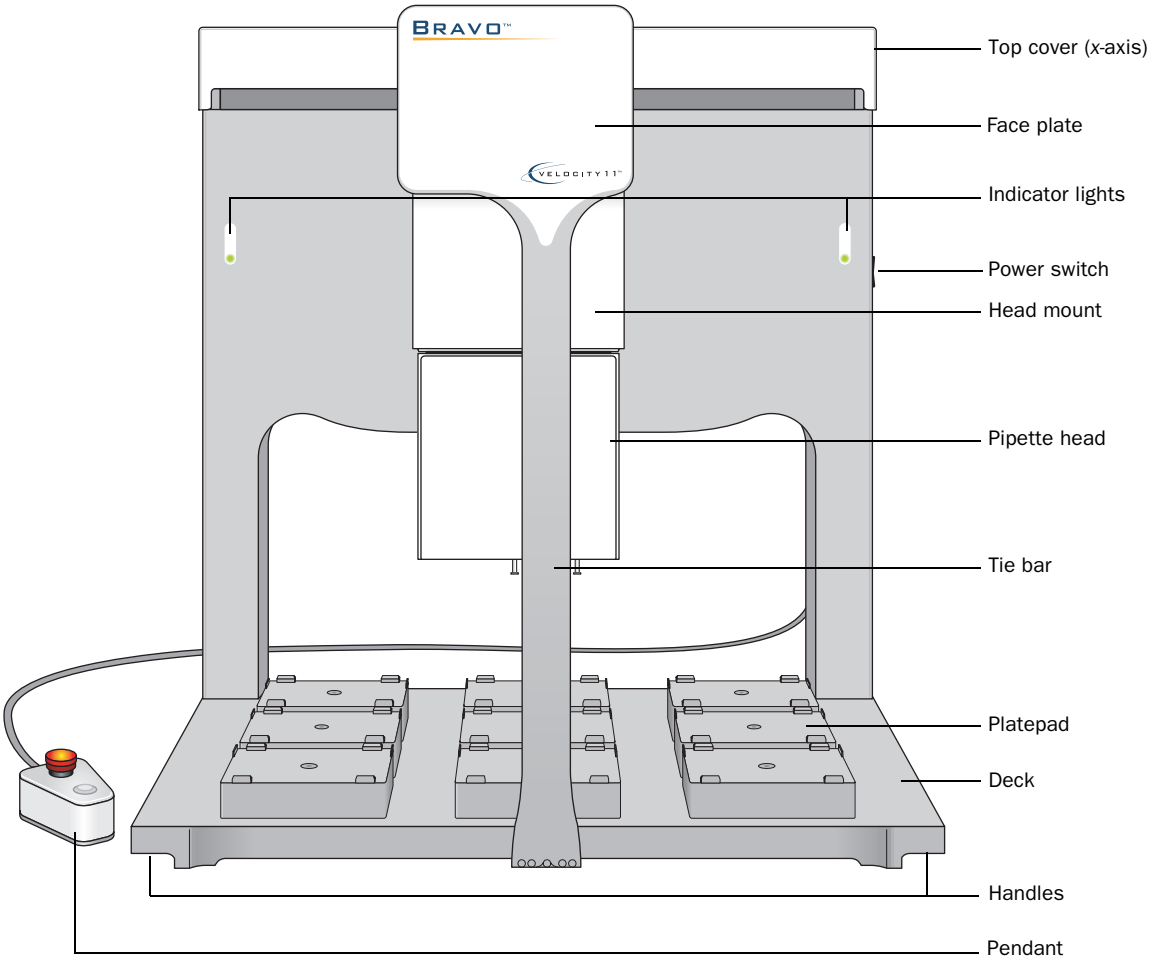
About this topic

This topic provides illustrations and descriptions of the Bravo's hardware features.

Overview diagrams

Front view

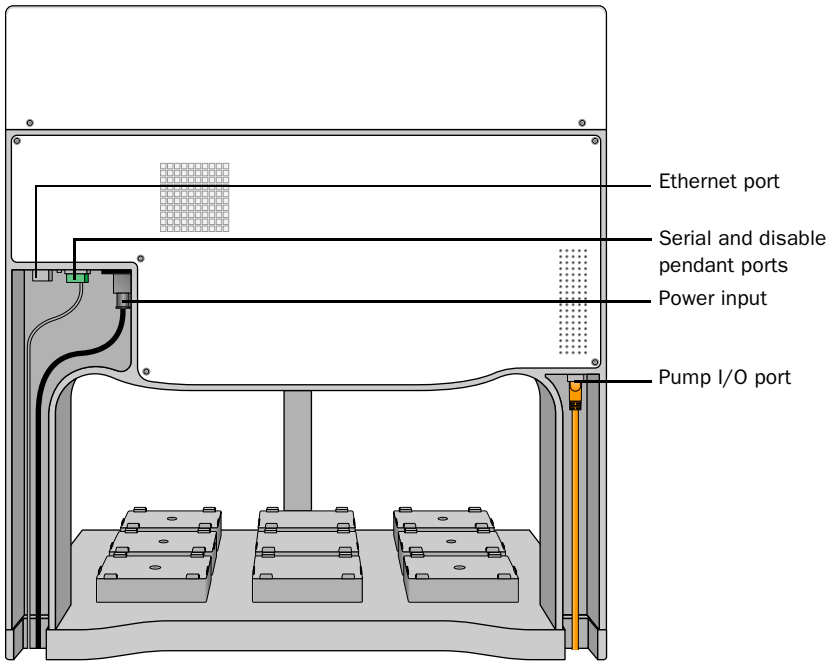
The following diagram shows the front view of the Bravo. The table below the diagram describes the hardware features shown in the diagram.



Feature	Description
Arm cover (not shown)	The cover that lies along the Bravo's *y*-axis. It extends behind the face plate.
Face plate	The white plate that is attached with magnets. It displays the Velocity11 and Bravo logo.
Top cover	The cover that lies along the Bravo's *x*-axis.
Head mount	The fixture to which the pipette head mounts along the *x*- and *y*-axes. You can physically move the head mount while the Bravo is turned off.
Indicator lights	The colored lights that show the status of the Bravo. Each light panel has four colors: red, orange, green, and blue.
Tie bar	The bar that runs vertically at the front of the device to add structural support to the Bravo. **!! DAMAGE HAZARD !! Never tug at or try to lift the Bravo by the tie bar.**
Pipette head	The Bravo-compatible pipette head that aspirates and dispenses fluid.
Deck location	The location on the deck that holds a platepad or an accessory. The Bravo ships with nine platepads, one on each location. You may need to remove a deck-mounted platepad to install certain accessories.
Connection panel (shown on back view)	The panel on the back of the Bravo that contains AC power entry, the fuse holder, and the Ethernet, serial, and pendant ports.
Deck	The area that is accessible by the pipette head. Made of aluminum, it supports nine deck locations.
Pendant	The small pendant that has two control function buttons: ❑ The Bravo disable button, which is red, raised, and illuminated ❑ The go button, which is silver and flush
Power switch	The on/off switch that turns the Bravo on and off. It is on the right side of the device.

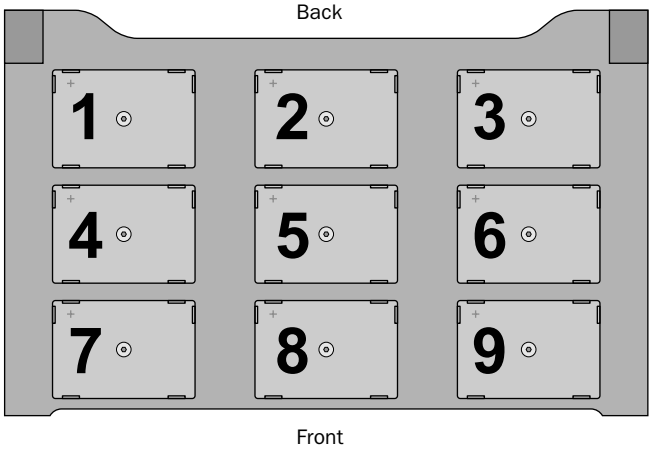
Back view

The following diagram shows the back view of the Bravo. The connections on the back of the Bravo are described in “Connection panel description” on page 21.



Deck locations

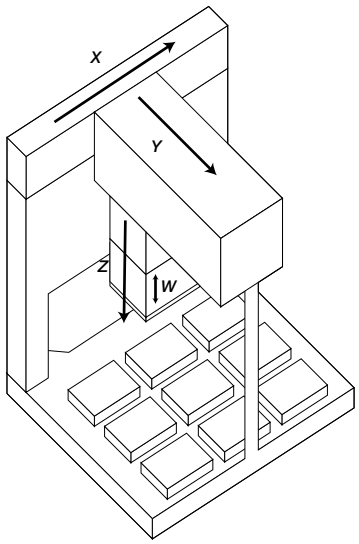
The deck locations are numbered 1–3, 4–6, and 7–9 from left to right as you face the front of the Bravo.



Bravo axes

The Bravo axes are referred to throughout this guide. The following diagram indicates the axes.

The *w*-axis is the displacement of the pipettor inside the pipette head.



Accessories

Bravo accessories are optional components that can be added to the device to enhance existing functions and facilitate operation. For a list and descriptions of the accessories, see “Bravo accessories” on page 109. To order an accessory or to obtain the latest list of accessories, contact Velocity11 Customer Service.

Related topics

For information about...	See...
Pipette head	“The Bravo pipette heads” on page 18
Indicator lights	“Indicator lights” on page 17
Accessories	“Bravo accessories” on page 109

Indicator lights

About this topic

This topic describes the code for the Bravo's indicator lights.

Indicator light meaning

Two lights on the front of the Bravo display different colors to indicate the status of the device. The following table lists the possible colors and the corresponding status description.

Light color	Status	Meaning
Solid blue	Standby	The Bravo is powered on.
Flashing green	Protocol	The software is running a protocol.
Flashing orange	Initialized and in Bravo Diagnostics	The software has initialized the Bravo and Bravo Diagnostics is open.
Flashing red	Error in protocol	The software has encountered an error while performing a protocol.

Related topics

For information about...	See...
The location of the indicator lights	"Hardware overview" on page 13

The Bravo pipette heads

About this topic

The Bravo uses interchangeable pipette heads that can dispense fluid into entire plates at once, or into a single column or row.

There are several different pipette heads that use either disposable tips or fixed tips. This topic describes the pipette heads that are available for the Bravo.

Disposable-tip pipette heads

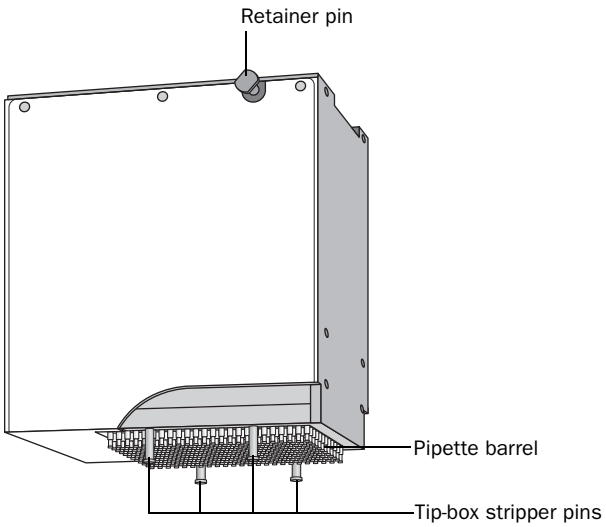
Disposable-tip pipette heads allow you to change pipette tips during a run to prevent cross-contamination. Two types of disposable-tip pipette heads are available for use on the Bravo:

- ❑ The Series II 96-well and 384-well pipette heads dispense fluid into all the wells in a plate simultaneously. The Series II pipette heads are included with the Velocity11 VPrep product and can be upgraded to a Series III pipette head. Contact Velocity11 Customer Service for upgrade details.
- ❑ The Series III 96-well and 386-well pipette heads can dispense fluid into all the wells in a plate simultaneously or into a single column or single row in the plate. The Series III pipette heads are shipped with the Bravo.

Both Series II and Series III pipette heads allow you to use large tips (LT) to dispense up to 200 µL per well or small tips (ST) to dispense up to 70 µL per well. The following table lists the Series II and Series III pipette heads available for the Bravo.

Head type	Max volume	Dispense into...
8LT	200 µL	96-well, 384-well plates; single column (8 wells)
16ST	70 µL	384-well, 1536-well plates; single column (16 wells)
96LT	200 µL	96-well, 384-well plates; single column (8 wells) or row (12 wells)
96ST	70 µL	96-well, 384-well plates; single column (8 wells) or row (12 wells)
384ST	70 µL	384-well, 1536-well plates; single column (16 wells) or row (24 wells)

The following diagram shows a Series III 384-well disposable-tip pipette head.



Fixed-tip pipette heads

96-well and 384-well fixed-tip pipette heads are fitted with non-disposable dispensing pins and can dispense fluid into an entire plate simultaneously. They cannot be used to dispense fluid into single columns or single rows. The following table lists the fixed-tip pipette heads available for the Bravo.

Head type	Max volume	Dispense into
96F	50 µL	96-well, 384-well plates
96F	200 µL	96-well, 384-well plates
384F	50 µL	384-well, 1536-well plates

Serial dilution capabilities

You can use the Series III 96-well and 384-well pipette heads for serial dilution tasks because these pipette heads can dispense fluid into single columns or single rows of a plate. You do not need to change pipette heads during the task.

Note: When using the heads in serial-dilution mode, certain deck locations will not be accessible.

Controlling the pipette heads

The Bravo pipette heads are controlled through VWorks. Through VWorks, you can:

- ❑ Calibrate volumes
- ❑ Control pipette speed
- ❑ Enable tip touching
- ❑ Enable dynamic tip extension and retraction

Related topics

For more information about...	See...
Serial dilution	*VWorks User Guide*
Installing a pipette head	“Mounting the pipette head” on page 59
Changing a pipette head	“Removing pipette heads” on page 146
Controlling pipette heads	*VWorks User Guide*

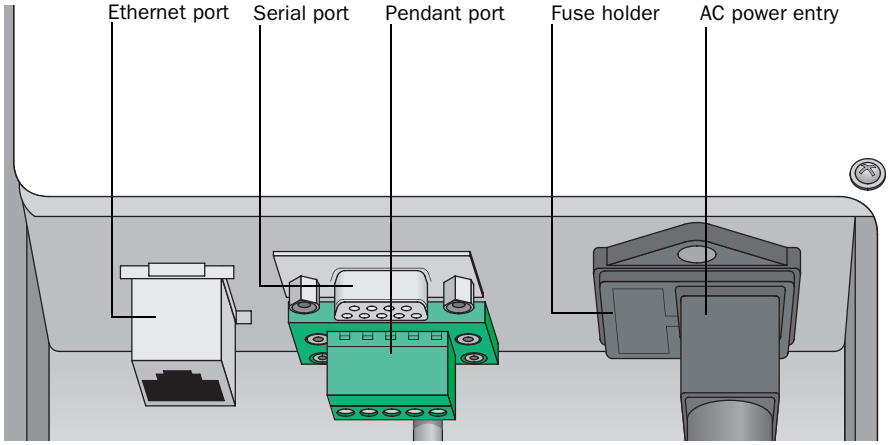
Connection panel description

About this topic

This topic describes the connection panel inputs and outputs on the Bravo.

Connection panel diagram

The following diagram shows the features of the connection panel at the rear of the Bravo. The table below describes the connections in detail.

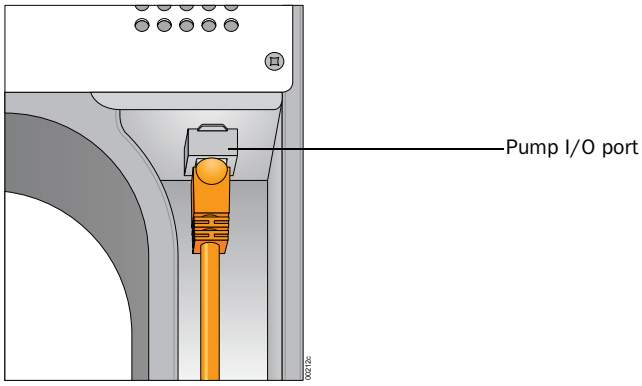


Feature	Description
Serial port	An RS-232 serial port that provides serial connection to the Bravo and firmware programming. If you connect the Bravo using the serial port, you do not need to connect using the Ethernet port.
Ethernet port	An Ethernet port that provides an Ethernet connection to the Bravo and firmware programming. If you connect the Bravo using the Ethernet port, you do not need to connect using the serial port.
Pendant port	The port that connects the pendant to the safety interlock circuit. The Bravo is equipped with a safety interlock circuit that must be closed for the Bravo to operate. The pendant's disable button interrupts this circuit. The circuit can also be fitted with a light curtain to shut off power to the Bravo if the light boundary is breached. Light curtains are available from Velocity11 as a custom option.

Feature	Description
AC power entry	The port that connects the Bravo power cord to an AC outlet with a grounded circuit.
Fuse holder	The enclosure that contains the main fuse and a place for a spare fuse. Use 250 V, 10 A, 5-mm x 20-mm fuses.

Pump I/O port

The following diagram shows the Pump I/O port on the back of the Bravo. The table below describes the Pump I/O port in detail.



Feature	Description
Pump I/O port	An RJ-45 I/O port that enables you to connect a peristaltic pump to the Bravo. The connection is made with a straight-through shielded Cat-5 or Cat-6 (Ethernet) cable. *Note:* This is not an Ethernet port and should only be used to connect Velocity11 accessories to the Bravo.

Related topics

For more information about...	See...
Connecting the Bravo	“Connecting the Bravo” on page 36
Connecting with Ethernet or serial cable	“Choosing between a serial and an Ethernet network” on page 38
The pendant’s disable button	“Stopping the Bravo in an emergency” on page 77
Installing a Light Curtain	“Light Curtain” on page 119

Software overview

About this topic

This topic provides a brief overview of the VWorks software and explains how to operate the Bravo.

VWorks

VWorks is the automation software that controls the Bravo. VWorks allows you to specify a sequence of tasks (for example, aspirate, dispense, or mix), compiles the task sequence into a protocol, and then executes them as automated runs.

VWorks complies with the United States code of regulations Rule 21 CFR Part 11 to ensure the integrity of electronic records. All operations performed are written to an output file. An authorized administrator has the ability to limit users' access to the system and records. For example, a user logged in as an operator may have the privilege to run protocols but not to create or edit them, while another type of user, such as a technician, can do both. All events are recorded with a time stamp and cannot be deleted or edited from within VWorks.

Bravo Diagnostics

The Bravo has its own diagnostics interface within VWorks that enables you to:

- *Create, edit, save, and load profiles.* These are registry settings that contain communication, head type, and teachpoint settings that VWorks uses to execute protocols. The profiles also store configure deck location information.
- *Home and jog.* You can use the jog buttons to move the pipette head incrementally and the home buttons to move the head to the home position.
- *Create teachpoints*. These are instructions that tell the pipette heads exactly where to move to perform a task.
- *Configure deck locations.* These, for example, specify which location on the Bravo's deck is a MicroWash Station. The location information is stored in the profiles.
- *Execute individual tasks.* Tasks that are performed in a run (such as Tips Off, Tips On, Aspirate, and Dispense) can be executed individually through diagnostics.

ActiveX

The Bravo has an ActiveX control that enables it to be controlled by another company's software.

Contact Velocity11 Technical Support for more information about the ActiveX control for the Bravo.

Related topics

For more information about...	See...
Setting up the Bravo	“Setting up the Bravo” on page 57
Using Bravo Diagnostics	“About Bravo Diagnostics” on page 82
VWorks	*VWorks User Guide*

Installing the Bravo 3

This chapter covers unpacking the Bravo and its computer and setting up a network to connect to the computer.

This chapter contains the following topics:

- ❑ "Laboratory setup requirements" on page 26
- ❑ "Electrical and environmental requirements" on page 28
- ❑ "Workflow for installing the Bravo" on page 29
- ❑ "Unpacking and inspecting the Bravo" on page 30
- ❑ "Connecting the Bravo" on page 36
- ❑ "Choosing between a serial and an Ethernet network" on page 38
- ❑ "About Ethernet networking" on page 39
- ❑ "Workflow for Ethernet networking" on page 42
- ❑ "Changing the Bravo's IP address to be assigned dynamically" on page 43
- ❑ "Setting the network card's IP address" on page 46
- ❑ "Connecting Ethernet cables" on page 49
- ❑ "Checking the Ethernet card's IP address" on page 51
- ❑ "Installing and starting DHCP server software" on page 52
- ❑ "Turning off Ethernet firewall software" on page 55

Laboratory setup requirements

About this topic

This topic describes the space and bench requirements for the Bravo. Read this topic and "Electrical and environmental requirements" on page 28 before you unpack and install the Bravo.

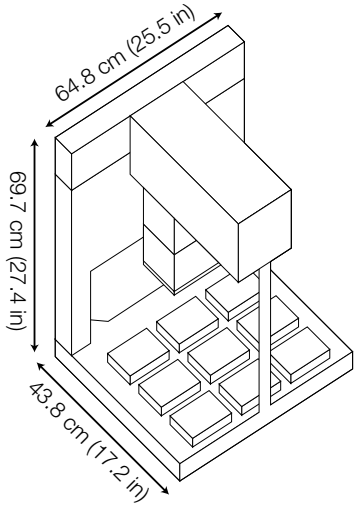
Space and bench requirements

Place the Bravo where there is:

- ❑ Proximity to power
- ❑ Enough space to accommodate the Bravo, computer, monitor, pendant, and accessories
- ❑ A fixed bench (without wheels) that can support the weight of the Bravo without excessive shaking or movement
- ❑ Easy access so that you can quickly disconnect the power to the Bravo if the need arises

Physical specifications

Dimension	Value
Height	69.7 cm (27.4 in)
Width	64.8 cm (25.5 in)
Depth	43.8 cm (17.2 in)
Weight	52.1 kg (114.9 lb)



Related topics

For information about...	See...
Electrical and environmental requirements	“Electrical and environmental requirements” on page 28
The workflow for installing the Bravo	“Workflow for installing the Bravo” on page 29

Electrical and environmental requirements

About this topic

This topic describes the electrical and environmental requirements the Bravo needs to operate properly. Read this topic and "Laboratory setup requirements" on page 26 before you unpack and install the Bravo.

Electrical supply

The Bravo has the following electrical requirements:

Requirement	Value
Voltage	100–240 V~
Frequency	50–60 Hz
Current	11.5 A @ 115 V~ 6.5 A @ 230 V~
Fuse	250 V, 10 A 5 mm x 20 mm

Environmental operating requirements

Requirement	Value
Temperature	0–40 °C
Relative humidity	0–95% RH, non-condensing
Elevation	1–2000 m

Related topics

For information about...	See...
Laboratory requirements	"Laboratory setup requirements" on page 26
Installing the Bravo	"Workflow for installing the Bravo" on page 29

Workflow for installing the Bravo

About this topic

This topic gives the procedures you need to follow to install the Bravo.

Workflow

Step	Topic
1	“Unpacking and inspecting the Bravo” on page 30
2	“Connecting the Bravo” on page 36
3	“Workflow for Ethernet networking” on page 42

Unpacking and inspecting the Bravo

About this topic

The Bravo is shipped in two boxes. The instrument and packing kit arrive together in the instrument box. The computer arrives in its own box. This topic describes the shipped items and how to safely unpack them.

Before you start

Before you unpack the Bravo:

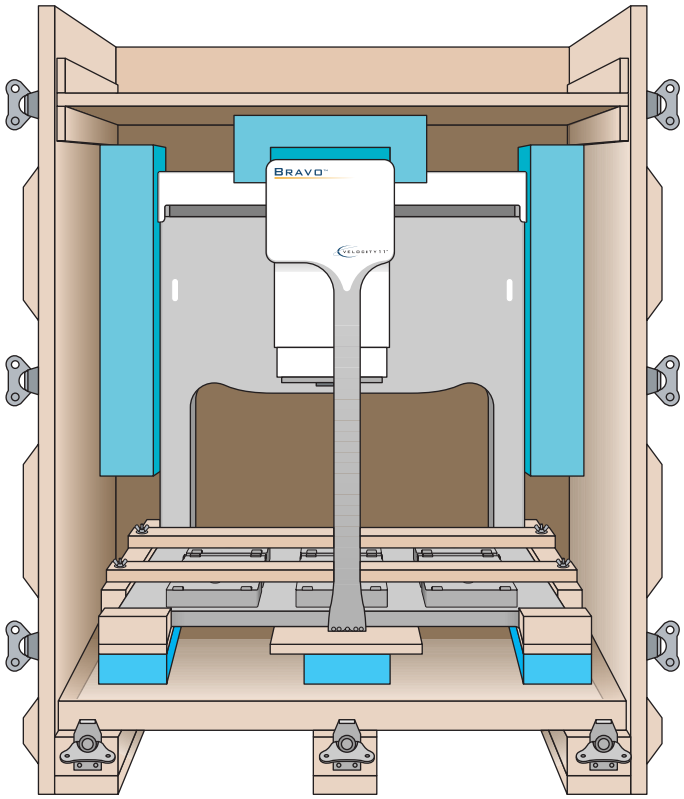
1. Make sure the final location is nearby and easily accessible.
2. Make sure you have the following equipment:
   - A Phillips-head screw driver to remove screws on the top cover
   - A 3 mm hex wrench to remove the M4 screws from the *x*-axis shipping stops
   - A 2.5 mm hex wrench to remove M3 screws from *y*-axis shipping stops
3. Remove the top of the instrument crate and verify it has the following items:
   - Pendant
   - Power cable
   - Serial cable
   - Crossover Ethernet cable
   - *Bravo User Guide*
   - CD-ROM containing VWorks software

Procedure

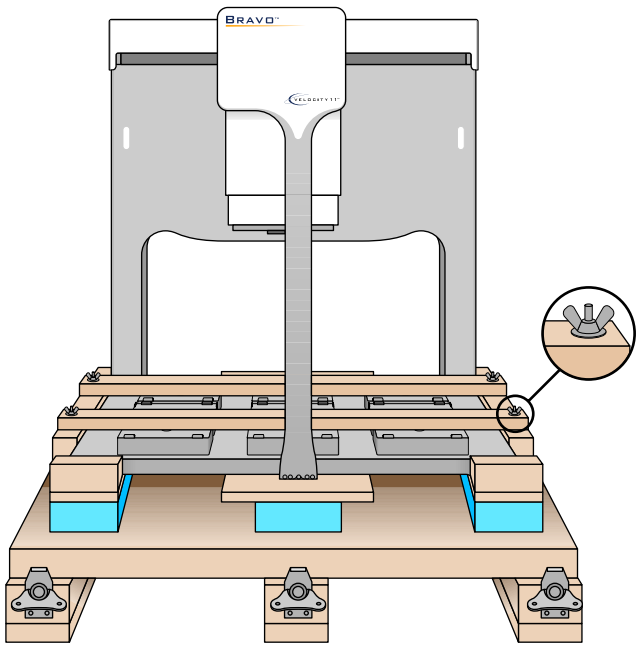
!! IMPORTANT !! Save the packaging materials in case you need to move or ship the Bravo.

To unpack the Bravo:

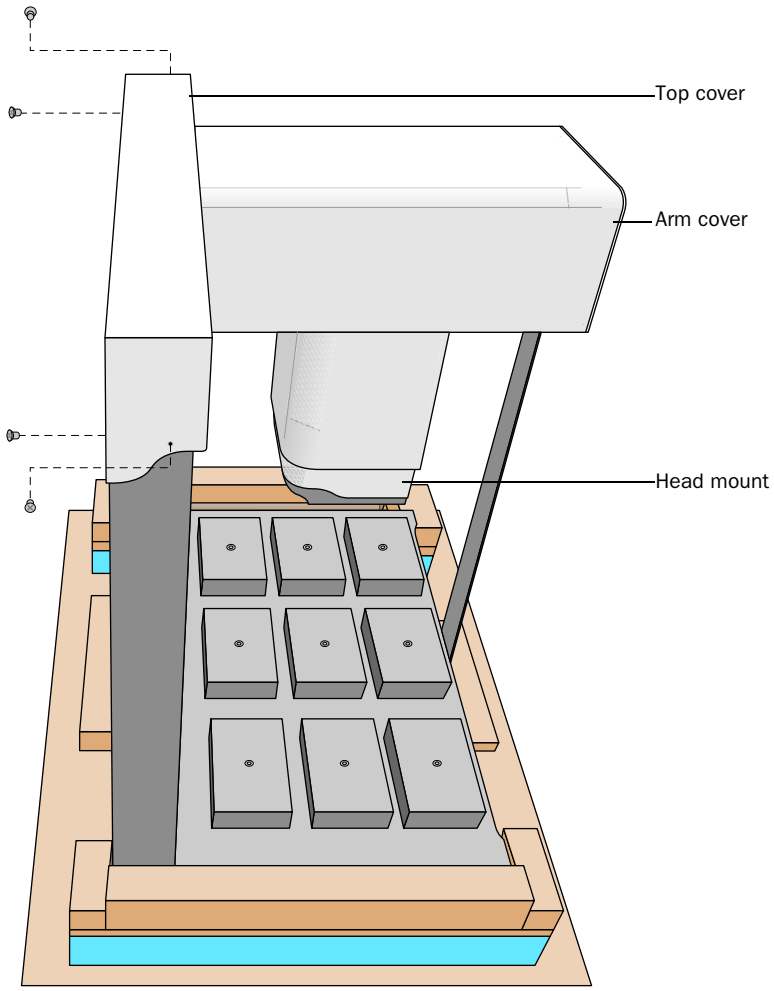
1. Open the latches and remove the front of the crate.



2. Remove the sides and top from the crate.
3. Undo the wing nuts and remove the slats that hold the Bravo to the crate's base.

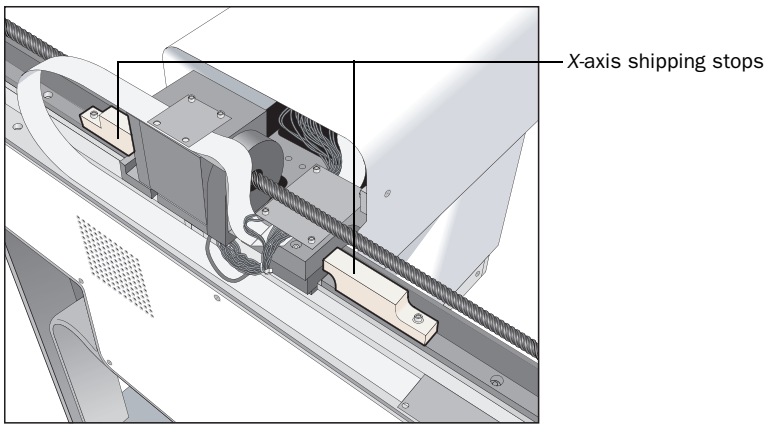


4. Remove the shipping stops:
   a. Remove the top cover by removing the four Phillips head screws located on the side and back of the cover.



   b. Remove the two shipping stops under the top cover. Each stop is held in place with an M4 screw.

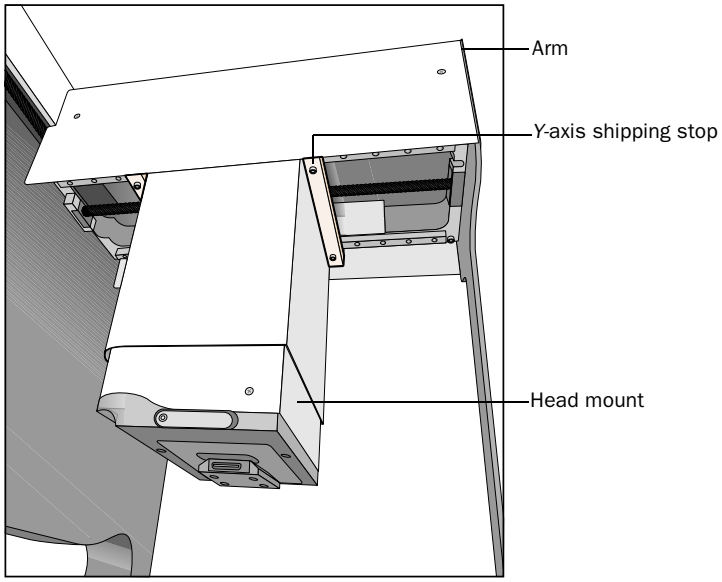
      These shipping stops prevent the head mount from moving in the *x*-axis during shipping.



c. Replace the top cover.

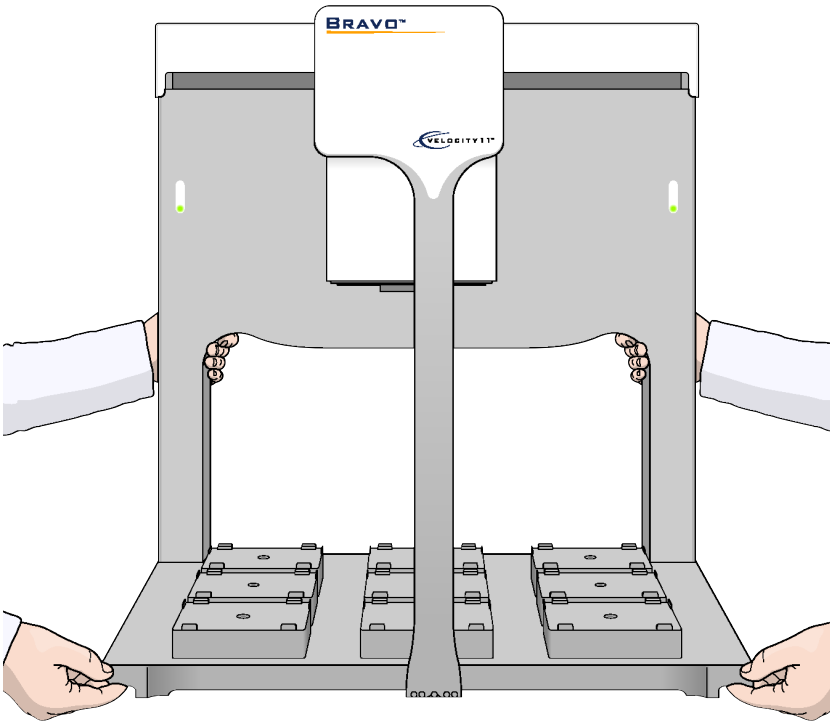
d. Remove the shipping stop on either side of the head mount. Each stop is held in place with two M3 screws.

   These shipping stops prevent the head mount from moving in the *y*-axis during shipping.

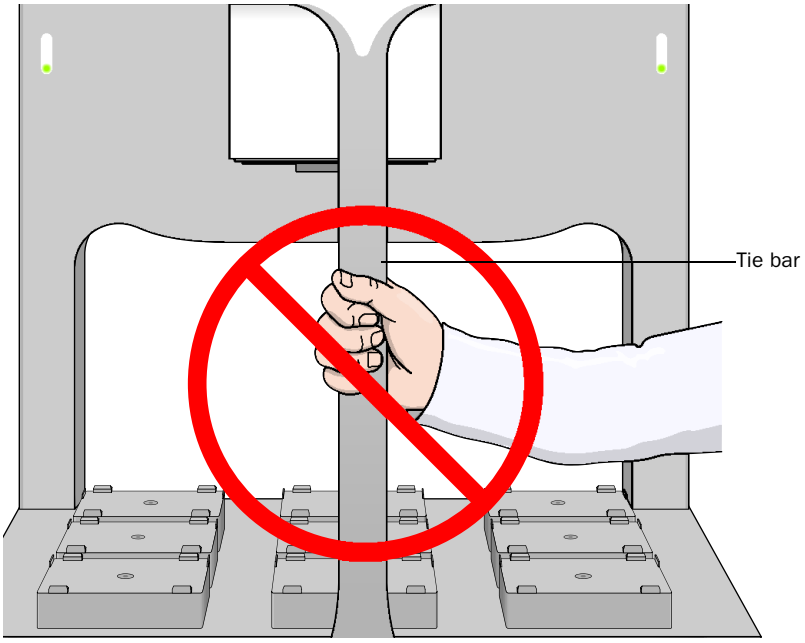


5. Lift the Bravo onto the lab bench or table. Use the lift points shown in the following diagram.

!! INJURY HAZARD !! The instrument weighs 115 lbs and requires at least two strong people to lift it.



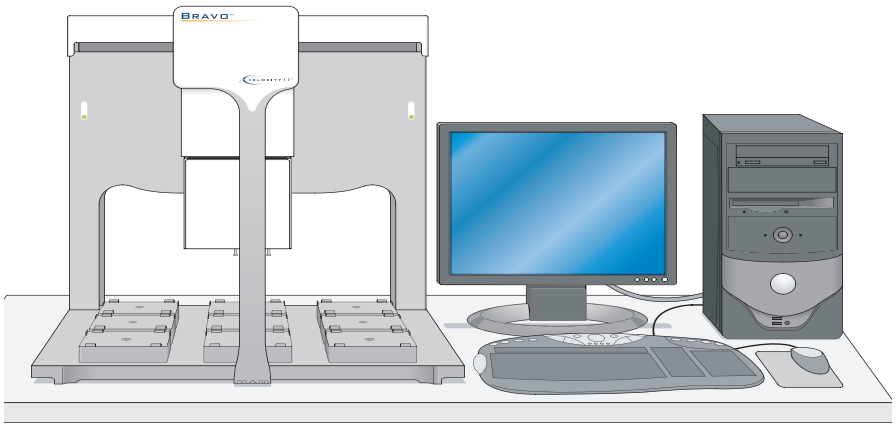
!! DAMAGE HAZARD !! Never lift from, or tug on, the tie bar.



6. Unpack the computer from its box according to the instructions included with the computer, and place it near the instrument.

   Refer to the Bravo layout diagram below.

Bravo layout



Related topics

For information about...	See...
The workflow that this procedure belongs to	"Workflow for installing the Bravo" on page 29
What to do next	"Connecting the Bravo" on page 36
Set up requirements	❑ "Laboratory setup requirements" on page 26 ❑ "Electrical and environmental requirements" on page 28
Hardware components	"Hardware overview" on page 13
Connection panel description	"Connection panel description" on page 21

Connecting the Bravo

About this topic

This topic provides instructions on how to connect the Bravo to a grounded power source and to its controlling computer.

Before you start

Before you plug in the Bravo, make sure the laboratory set up requirements have been met.

Procedure

To connect the Bravo:

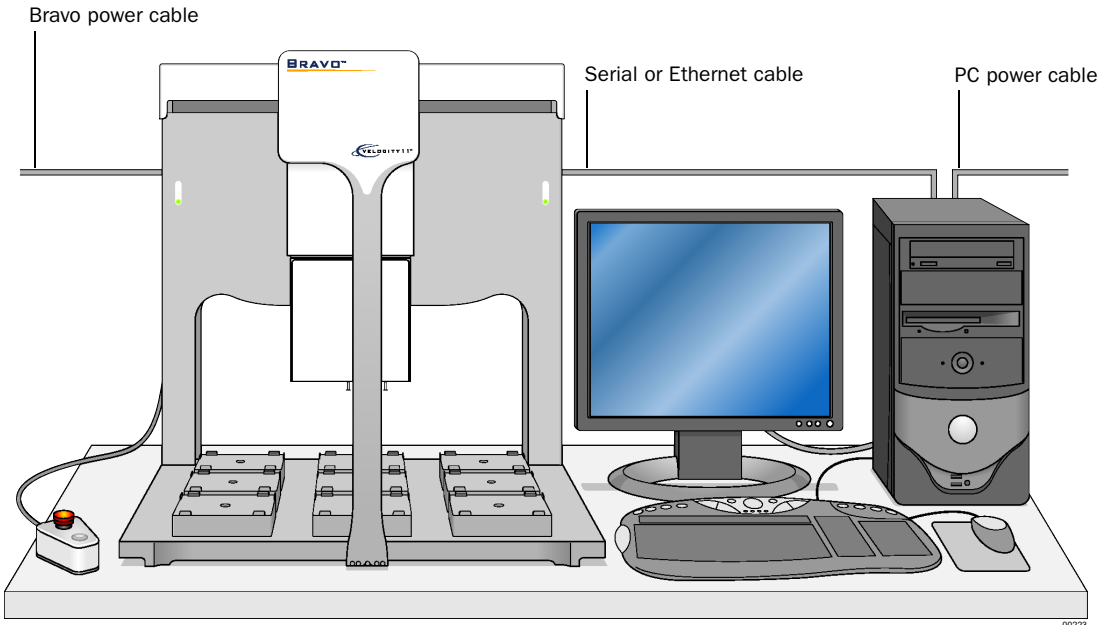
1. Plug one end of the Bravo's power cord into the AC power entry located on the connection panel on the back of the Bravo. Plug the other end of the cord into an AC outlet with a grounded circuit.
2. Follow the instructions included with the computer for connecting it.
3. Plug the pendant into the pendant port on the back of the Bravo.
4. Connect the Bravo to the computer:
   a. If using a serial connection:

      Plug the supplied serial cable into the serial port on the Bravo.

      Plug the other end of the cable into one of the computer's serial ports.

   b. If using an Ethernet connection, refer to the topic about connecting Ethernet cables.

   Note: If you are not sure which type of connection to use, refer to the topic on choosing between a serial and Ethernet network.



Related topics

For information about...	See...
The connection panel	"Connection panel description" on page 21
The workflow that this procedure belongs to	"Workflow for installing the Bravo" on page 29
Set up requirements	❑ "Laboratory setup requirements" on page 26 ❑ "Electrical and environmental requirements" on page 28
Deciding between a serial or Ethernet connection	"Choosing between a serial and an Ethernet network" on page 38
Connecting with Ethernet	"Workflow for Ethernet networking" on page 42

Choosing between a serial and an Ethernet network

About this topic

The Bravo can be connected to the computer by either a serial or an Ethernet connection. If you do not know which you want to use, reading this topic can help you decide.

Connection options

You can connect your Bravo to the controlling computer using either:

- ❑ A serial network
- ❑ An Ethernet network

How to choose

Why serial might be better

Connecting the computer to devices using a serial cable is simpler than connecting with an Ethernet cable. With serial, there is no network card to install, no IP addressing to set up, and no software to install.

Serial connections have another advantage. If your controlling computer has an Ethernet network card, you do not have to use it for the lab automation network so you can use it to connect to your building's general Ethernet network.

Why Ethernet might be better

Ethernet is a faster, more reliable, and more flexible communication technology than serial. Depending on the specifications of your computer, you might experience communication problems with a serial network, in which case you will have to use an Ethernet network.

Another advantage of Ethernet networking is that you can run many devices from a single network port on your computer. Serial connections require one port for every device. If you are planning to network more than one Bravo, your computer might not have enough serial ports so you will have to add more.

Related topics

For information about...	See...
The workflow that this procedure belongs to	"Workflow for Ethernet networking" on page 42
Connecting with Ethernet	"Connecting Ethernet cables" on page 49
Connecting with serial	"Connecting the Bravo" on page 36

About Ethernet networking

Network requirements

Network cards

Every device and computer requires a network card to communicate with each other. All Velocity11 devices have a network card built in. Your Bravo desktop computer has two network cards. One to communicate with the Bravo and the other to be used to communicate with your lab's general network (for email, internet access, and so on).

Network connections

Ethernet cables are used to make the physical connections between the device, the controlling computer, and local area network (if you have one).

You can use Ethernet cables to connect the Bravo and the controlling computer in a single-device setup, or you can use the Ethernet cables to connect the Bravo computer to a dedicated lab automation local area network.

If you plan to connect multiple Bravos, you need an Ethernet switch to connect the single Ethernet cable attached to your computer and multiple Ethernet cables to connect to each of the Bravos.

About IP addresses

IP address function

The computer and each device on the network must be assigned a different number, called an IP address. IP addresses allow computers and devices to be uniquely identified on a network so that information can be specifically routed to them.

Ways to assign an IP address

There are two ways to assign an IP address:

- ❑ Statically, by assigning it manually so that it never changes.
- ❑ Dynamically, by automatically assigning a new address every time the computer or device is turned on.

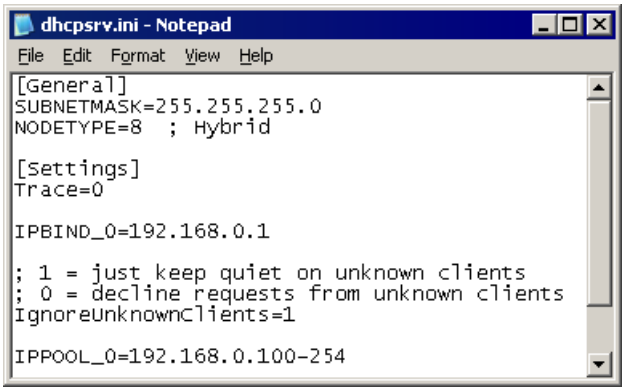
  Dynamic assignment uses DHCP (Dynamic Host Configuration Protocol) software.

The computer's IP address

It is important to consider separately the IP address of the computer and the IP addresses of the devices on the network.

The network card of the computer that is controlling the Bravo on a lab automation network always has a static IP address. This is even the case when the devices are dynamically assigned addresses because of the way that DHCP servers work. DHCP servers are usually configured to start when Windows starts.

When the server starts, it reads an initialization file that points it to the network card through which the computer will serve addresses. A screenshot of the initialization file is shown below.



Because the IP address and subnet mask in the file is static, the value of the network card's IP address and subnet mask must always match the values in this file. By convention, this address is 192.168.0.1.

!! INJURY HAZARD !! It is possible to run a Bravo on a general network in which both the Bravo and the controlling computer have dynamic IP addresses but Velocity11 cautions against this for safety reasons. Remote computer operators might accidentally initiate an operation that causes the device to move unexpectedly when lab personnel are nearby.

If the computer is also part of a general network, the second card should have a dynamic IP address because the computer does not control the network and the computer is easier to administer this way.

Bravo's IP address

The factory default is for the Bravo to have a static IP address of 192.168.0.82. However, you can change the IP address to be set dynamically.

Choosing an addressing method

Whether to assign the IP address of the Bravo statically or dynamically, depends on the network's architecture.

With a stand-alone connection

If you are connecting a single, stand-alone Bravo that will be set up this way long-term, set the IP address of the Bravo statically (or use a serial connection). This saves you from having to add a second network card to your computer and install DHCP server software.

When integrating into an existing LAN with DHCP

If you are connecting a Bravo to an existing local area network (LAN) that is already running a DHCP server, it is strongly recommended that you dynamically assign the IP address of the Bravo, and leave the statically set IP address of the computer's network card as it is.

When setting up a new LAN connection

If you are setting up a new LAN, you must decide whether to use static or dynamic IP addressing for the Bravo.

In general, if you have more than a few devices on your LAN, it is more convenient to use automatic addressing because you can remove and add devices without having to set up their IP addresses statically each time. If you only have a few devices, it might be more convenient to set them statically and avoid having to set up the DHCP software.

DHCP Server Kit

To make it easier for you to set up an Ethernet network, Velocity11 sells a DHCP Server Kit that includes:

- ❑ A networking card
- ❑ An Ethernet cable
- ❑ An Ethernet switch
- ❑ DHCP server software

The server supplied in the DHCP Server Kit works with computers running a Windows XP or Windows 2000 operating system.

Without the kit, you need to obtain the necessary parts yourself.

Related topics

For information about...	See...
Setting up Ethernet networking	“Workflow for Ethernet networking” on page 42
Connecting the Bravo	“Connecting the Bravo” on page 36

Workflow for Ethernet networking

About this topic

If you have not yet decided whether to use a serial or Ethernet connection to connect your Bravo to the controlling computer, read “Choosing between a serial and an Ethernet network” on page 38.

This topic guides you through the Ethernet connection setup process according to the type of network you want to set up.

Ethernet connection workflow

This is the workflow you use to set up an Ethernet connection.

Skip step 1 and step 5 if you are assigning IP addresses statically.

Step	Topic
1	Dynamic IP addresses only: “Changing the Bravo’s IP address to be assigned dynamically” on page 43
2	“Setting the network card’s IP address” on page 46
3	“Connecting Ethernet cables” on page 49
4	“Checking the Ethernet card’s IP address” on page 51
5	Dynamic IP addresses only: “Installing and starting DHCP server software” on page 52
6	“Turning off Ethernet firewall software” on page 55

Changing the Bravo's IP address to be assigned dynamically

About this topic

This topic describes how to change Bravo's IP address from a static assignment to a dynamic assignment using HyperTerminal.

You only need to follow this procedure if you do not want to use static IP address assignment.

Why do this

The Bravo is set up at the factory with a static IP address of 192.168.0.82.

If you want it to work with an Ethernet network that automatically assigns IP addresses, you need to reconfigure the Bravo's firmware to assign the Bravo's IP address dynamically.

Before you start

Make sure no other application is using the same serial port that you will use to connect the Bravo. For example, if you have recently reprogrammed a bar code reader, you may still have an open serial connection on the same port. To close the connection, correctly close the software application that is using the connection.

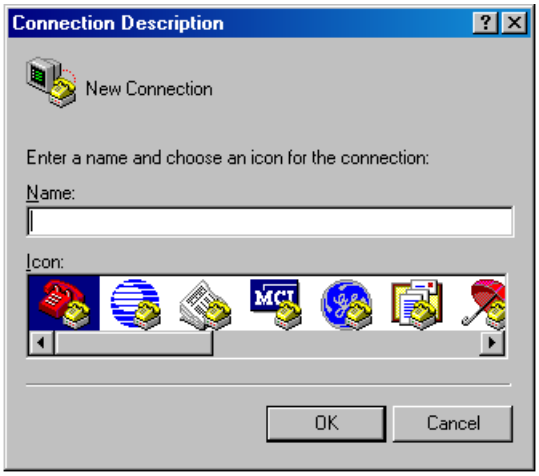
Procedure

Even though your goal is to set up an Ethernet connection, the only way to change the Bravo's IP address is to temporarily connect to the Bravo with a serial cable.

To set the Bravo's IP address to be assigned dynamically:

1. Physically connect a serial cable between the computer and the Bravo.
2. Use HyperTerminal to open a communication connection to the Bravo:
   a. In Windows, select **Start** > **Programs or All Programs** > **Accessories** > **Communications** > **HyperTerminal**.

      The **Connection Description** dialog box opens.



b. In the **Name** box, type a simple, one-word name for the connection, and click **OK**.

   The **Connect To** dialog box opens.

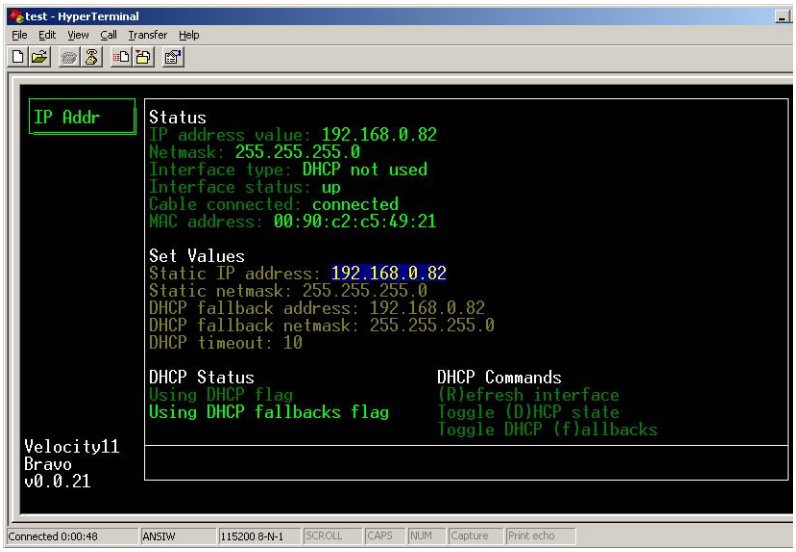
c. In the **Connect using** list, select the COM port on your computer to which the serial cable to the Bravo is connected and click **OK**.

d. Select the following port settings in the **Properties** dialog box and click **OK**.

Setting	Value
Bits per second	115200
Data bits	8
Parity	None
Stop bits	1
Flow control	None

   A serial connection is made to the Bravo and HyperTerminal presents a blank screen.

e. Press ENTER.



3. Select **Using DHCP flag** as follows:
   a. Press d (lower case) to highlight **Using DHCP flag**.
   b. Press r (lower case) to refresh the interface.

   Using DHCP flag is now highlighted, indicating that the IP address will now be set dynamically.

4. Check to make sure that the IP address starts with 192.168.
5. Press q (lower case) to quit from the Bravo remote terminal.
6. Exit HyperTerminal.
7. Disconnect the serial cable.

Related topics

For information about...	See...
The workflow that this procedure belongs to	“Workflow for Ethernet networking” on page 42
About Ethernet networking	“About Ethernet networking” on page 39

Setting the network card's IP address

About this topic

This topic describes how to manually set the IP address of the computer that controls your Bravo.

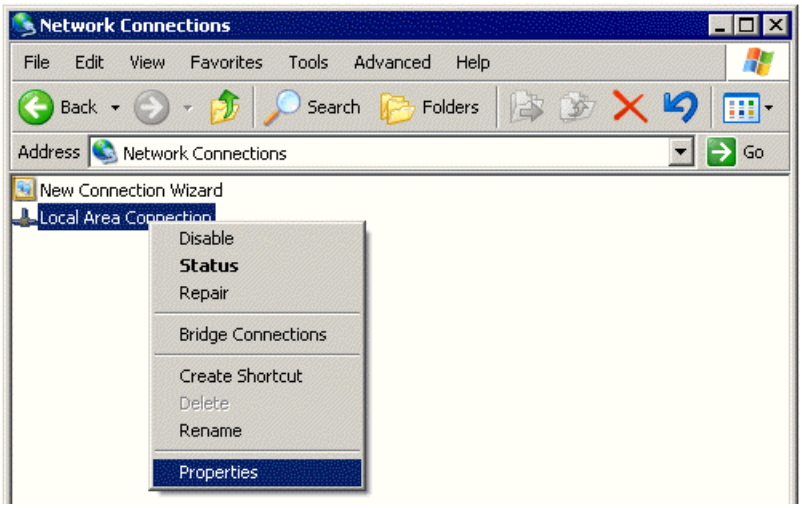
Ignore this procedure if you are setting up the computer supplied with your Bravo. In this case, the computer's network card should already be set up correctly.

However, if you are using a different computer (not the one supplied with your Bravo), follow the procedure in this topic to make sure the network card used to communicate with the Bravo is on the same subnet (192.168.0).

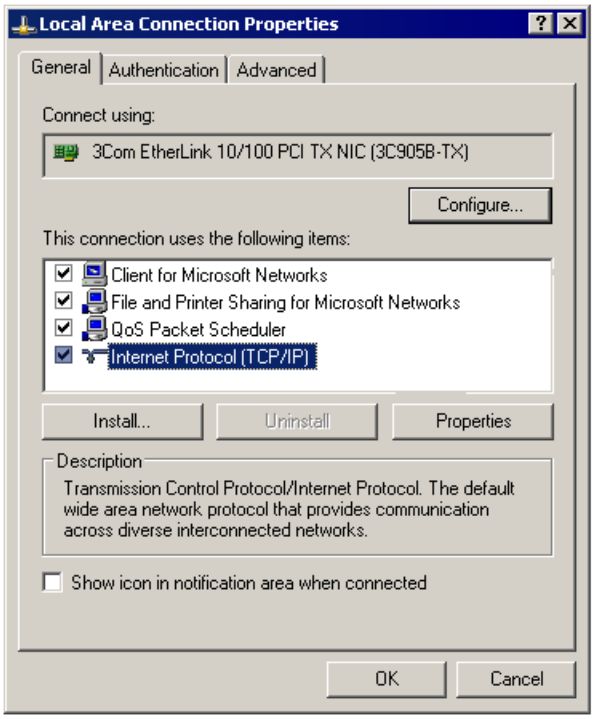
Procedure

To manually set the network card's IP address:

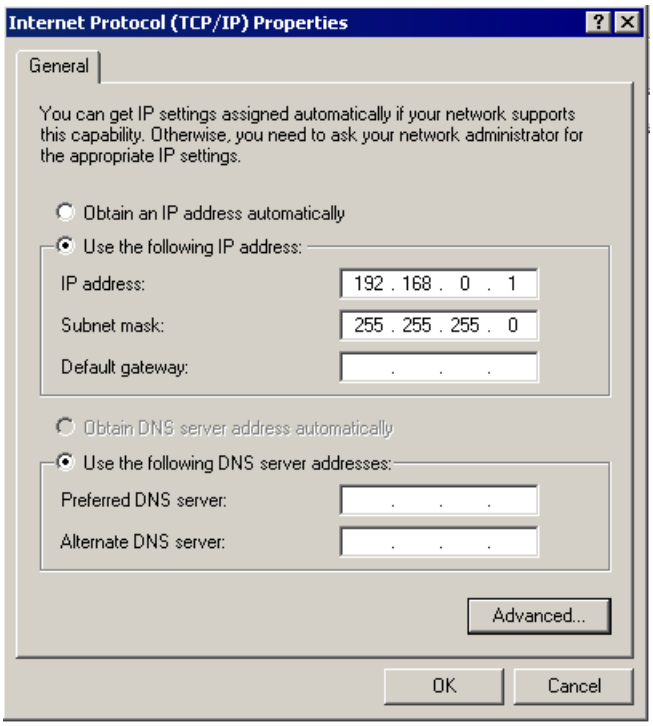
1. In Windows, select **Start** > **Settings** > **Network and Dial-up Connections**.
2. Right-click the icon for the new local area connection (which might be **Local Area Connection 2** on your system), and click **Properties**.



3. Double-click **Internet Protocol (TCP/IP)**.



This manually configures the IP address of the card.


Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
192 . 168 . 0 . 1
Subnet mask:
255 . 255 . 255 . 0
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

4. Click **OK**.
5. Close the **Network Connections** window.

Related topics

For information about...	See...
The workflow that this procedure belongs to	“Workflow for Ethernet networking” on page 42
About Ethernet networking	“About Ethernet networking” on page 39

Connecting Ethernet cables

About this topic

This topic describes two ways to connect Ethernet cables between a Bravo and the computer.

Ways to connect

You can use Ethernet to connect a Bravo to the computer:

- ❑ Directly
- ❑ Through an Ethernet switch

If you are setting up a stand-alone Bravo, you can use either method. If you are setting up a local area network that has other devices on it, follow only the directions for using a switch.

Before you start

Before starting this procedure and if you are setting up a new network, make sure that the IP address of the computer's network card has already been statically assigned.

Connecting directly

To connect your Bravo directly to the computer, you need the crossover Ethernet cable (supplied).

To connect directly to the computer with Ethernet:

1. Connect a crossover Ethernet cable to the Ethernet port of the connections panel.
2. Connect the other end of the cable to the Ethernet port of the computer.

Connecting through a switch

An Ethernet switch connects the single cable from the computer to one or more cables that lead to one or more devices. A switch is included in the Velocity11 DHCP Server Kit.

Note: Do not use a crossover cable with a switch. The switch performs the crossover function.

If you are setting up a new network, connect the Ethernet switch to the computer and then connect the Bravo to the Ethernet switch using the procedures in this section.

If you are adding a Bravo to an existing LAN, you do not need to perform the first procedure because the switch should already be connected.

To connect the switch to the computer:

1. Connect the power cord to the switch.
2. Plug one end of the Ethernet cable into any Ethernet port of the switch.
3. Plug the other end into the available Ethernet port of the computer.

To connect a Bravo to the switch:

1. Plug one end of a second Ethernet cable into any available port of the Ethernet switch.
2. Plug the other end into the Ethernet port of the Bravo.

Connecting additional Bravos

You can connect as many devices to the network as there are Ethernet ports available.

Related topics

For information about...	See...
The workflow that this procedure belongs to	“Workflow for Ethernet networking” on page 42
Connecting the Bravo	“Connecting the Bravo” on page 36
Setting the network card’s IP address	“Setting the network card’s IP address” on page 46

Checking the Ethernet card's IP address

About this topic

This topic describes how to verify the IP address of the network card in the computer.

Before you start

Before you can check the IP address of a computer, the computer's network card must have been manually assigned a static IP address.

Procedure

To check the IP address of a computer's network card:

1. On the computer whose IP address you want to check, in Windows, select **Start** > **Programs** or **All Programs** > **Accessories** > **Command Prompt**.

   A Command Prompt window opens.

2. Type `ipconfig` and press ENTER.

   One IP address for every network card in your computer is shown.

Related topics

For information about...	See...
The workflow that this procedure belongs to	"Workflow for Ethernet networking" on page 42
Manually assigning a network card's static IP address	"Setting the network card's IP address" on page 46

Installing and starting DHCP server software

About this topic

Follow the procedure in this topic if you are setting up a new Ethernet local area network (LAN) with dynamic IP addressing and have already connected the Bravo to the computer.

What is a DHCP server

A DHCP server is a software program that dynamically assigns IP addresses to devices in a LAN when they are turned on. Once installed, the server runs as a Windows service that starts automatically when you start the computer.

The server software is included in the DHCP Server Kit from Velocity11.

!! IMPORTANT !! You should only run one DHCP server on one network, so do not install the Velocity11 DHCP server if you are integrating the Bravo into an existing network that has dynamic IP address assignment.

Installing the DHCP software

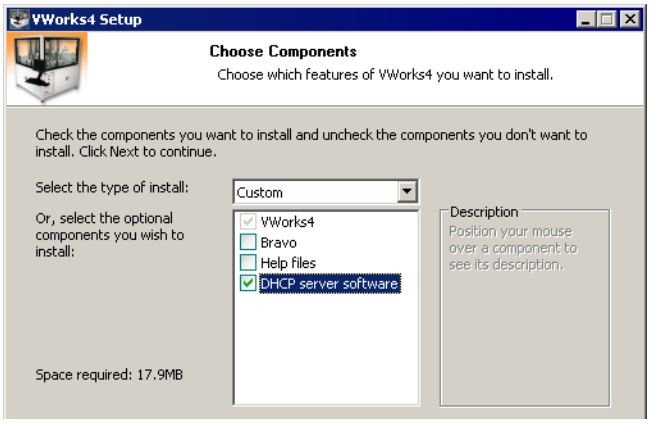
If you are using the computer that shipped with the Bravo, the DHCP server software should already be on the computer (and you should skip to the next procedure).

Note: Because the DHCP software runs as a service, you might need additional privileges on the controlling computer to install it. Check with your network administrator if you think you do not have sufficient privileges.

To install the DHCP server software:

1. Insert the Bravo (or VWorks) CD-ROM into the controlling computer's CD-ROM drive.
2. Double-click the setup.exe file.
3. Follow the instructions in the wizard to complete your installation.

   Make sure that you select DHCP server software.

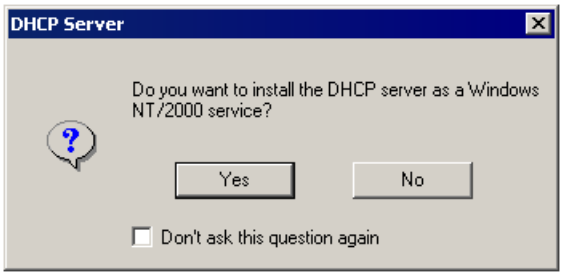

VWorks4 Setup
Choose Components
Choose which features of VWorks4 you want to install.
Check the components you want to install and uncheck the components you don't want to install. Click Next to continue.
Select the type of install:
Custom
Or, select the optional components you wish to install:
VWorks4
Bravo
Help files
DHCP server software
Description
Position your mouse over a component to see its description.
Space required: 17.9MB

Starting the DCHP server software

To install and restart the DHCP server software:

1. Navigate to the folder where the DHCP server software is installed, for example, C:\Program Files\Velocity11\VWorks4\DHCP.
2. Double-click the file named dhcpsrv.exe.

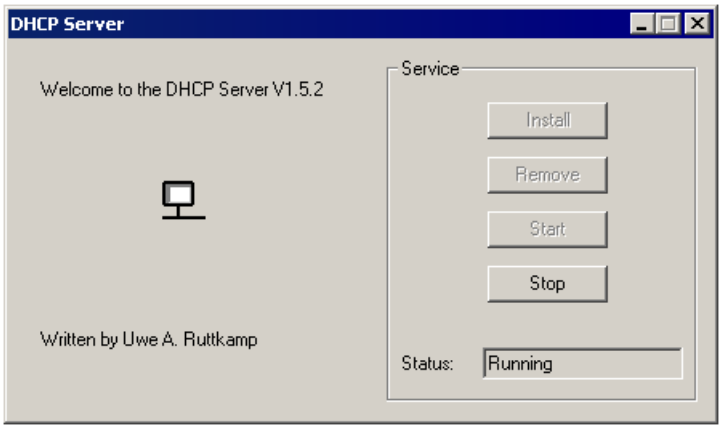
   The **DHCP Server** window opens.



3. Click **Yes.**

   This installs the DHCP server on your computer.

   The **DHCP Server** window opens and displays the status as **Running**.



4. Close the window.

Stopping and restarting the service

To stop and restart the DHCP server using the DHCP server file:

1. Navigate to C:\Program Files\Velocity11\VWorks4\DHCP.
2. Double-click the file named dhcpsrv.exe.
3. Click **Stop** to stop the service or **Start** to start the service.

Related topics

For information about...	See...
The workflow that this procedure belongs to	“Workflow for Ethernet networking” on page 42
Ethernet networking	“About Ethernet networking” on page 39

Turning off Ethernet firewall software

About this topic

If you are using an Ethernet network, read this topic to learn about the effect of firewalls and how to turn them off.

Firewall defined

A firewall is a security system that protects a computer on an Ethernet network against external threats.

Types of firewall

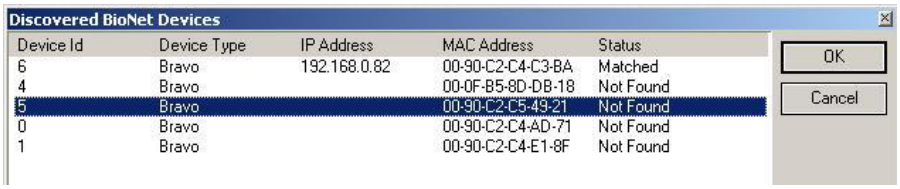
Hardware firewalls protect computers from threats outside the local area network (LAN). Software firewalls prevent worms from propagating on the internal network.

Sources of software firewall

The computer controlling the Bravo might have one or more software firewalls running on it. There are two software firewall sources to be concerned with:

- ❑ The Windows XP operating system has a built-in firewall that might be turned on by default or might have been turned on by someone in your organization.
- ❑ Your computer might be running a separate firewall program that your organization has purchased and installed.

Either of these types of firewall can prevent the devices on the network from showing up in the Discovered BioNet Devices dialog box.



With dynamic IP addressing

If your Ethernet network is using dynamic IP addressing, the firewall might block the request for an IP address from the Bravo when it is turned on.

With static IP addressing

If your Ethernet network is using static IP addressing, the Bravo software sends out a request for devices on the network to identify themselves, but the firewall might block the response.

About turning off firewalls

To turn off the firewall for your operating system, follow the directions in Windows Help and Support on your computer.

To turn off another firewall program, follow the directions in the documentation that accompanies the program. You can either uninstall the program or stop it. If you choose to stop it, make sure that the program is not configured to start up again every time you restart the computer.

Passing data through the firewall

If your organization insists that a firewall should remain on, it is possible to configure the firewall to allow data that is transmitted on a particular port to pass through.

If you are using dynamic IP addresses, the firewall should pass data though on UDP ports 67 and 7611.

If you are using static IP addresses, the firewall should pass data through on UDP port 7611.

For help configuring the firewall, consult your network administrator.

Related topics

For information about...	See...
The workflow that this procedure belongs to	“Workflow for installing the Bravo” on page 29
Ethernet networking	“About Ethernet networking” on page 39

Setting up the Bravo

4

This chapter explains how to set up the Bravo instrument and the VWorks software. Read this chapter after unpacking and installing your Bravo.

This chapter contains the following topics:

❑ "Workflow for setting up the Bravo" on page 58
❑ "Mounting the pipette head" on page 59
❑ "Turning on the Bravo" on page 63
❑ "Creating a profile for the Bravo" on page 64
❑ "Editing teachpoints" on page 68

Workflow for setting up the Bravo

About this topic

This topic outlines the procedures you need to follow to set up the Bravo.

Workflow

The general workflow for setting up the Bravo is:

Step	Topic
1	“Mounting the pipette head” on page 59
2	“Turning on the Bravo” on page 63
3	“Creating a profile for the Bravo” on page 64
4	“Editing teachpoints” on page 68

Mounting the pipette head

About this topic

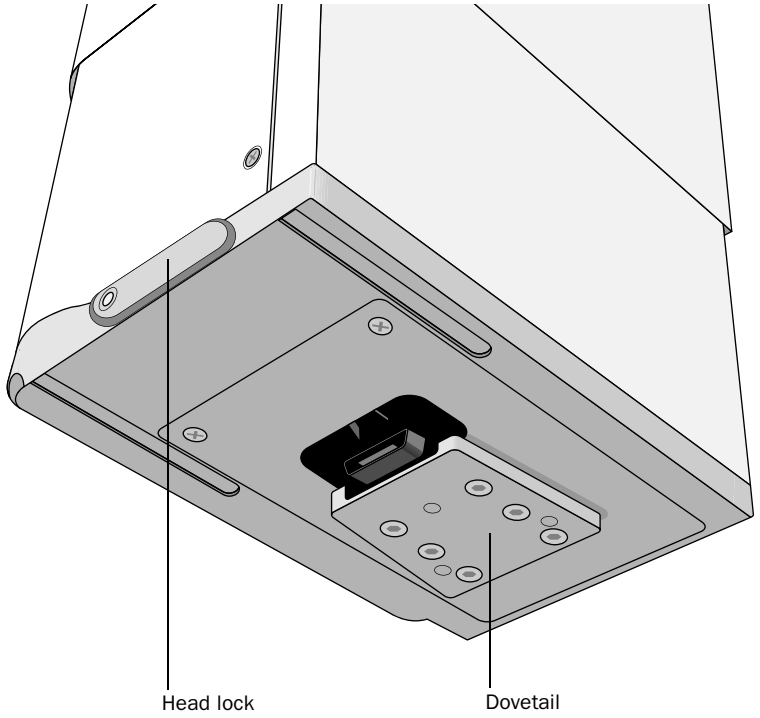
Both Series II and Series III Velocity11 pipette heads can be used on the Bravo. This topic describes how to mount a pipette head.

About the pipette head mount

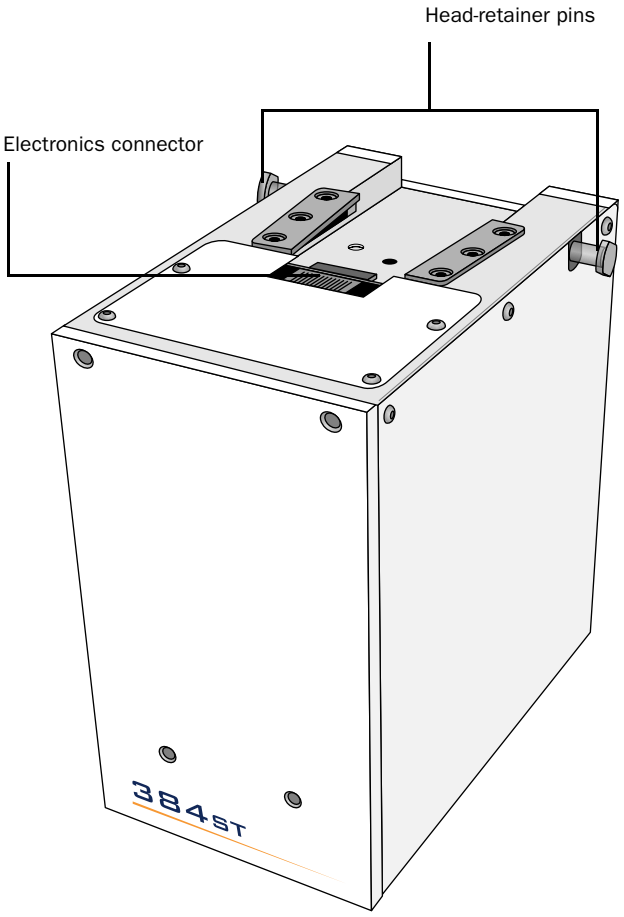
The pipette heads are mounted to the head mount with an angled dovetail interface and are secured with two head-retainer pins.

Familiarize yourself with the dovetail features both on the top of the pipette head and underneath the head mount before mounting the pipette head.

The following diagram shows the angled dovetail and head lock at the bottom of the head mount.



The following diagram shows a Series II pipette head.



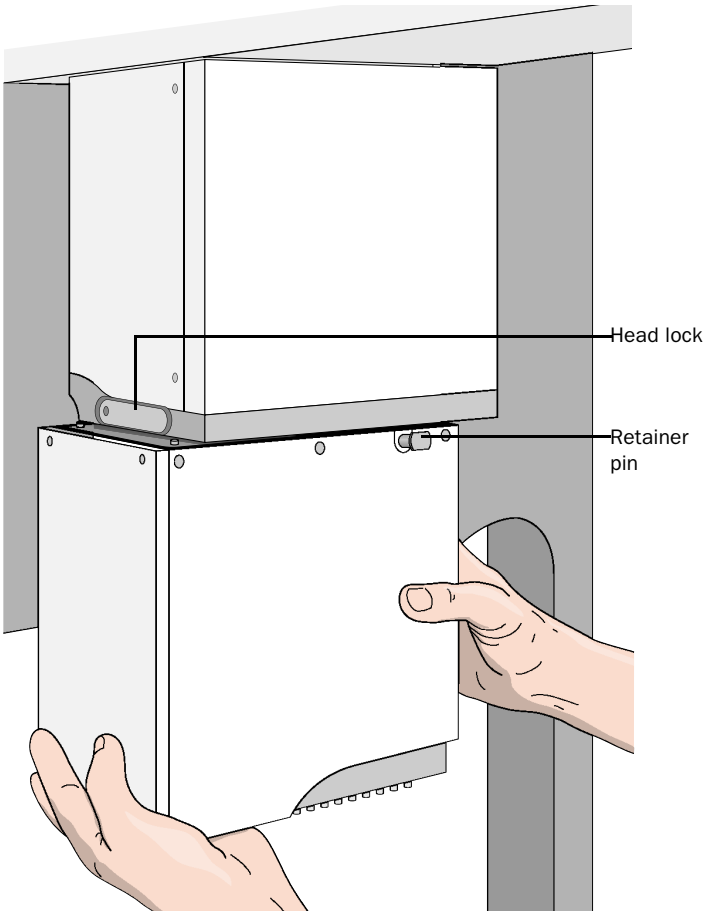
Procedure

To mount a Bravo pipette head:

1. Make sure that the head mount is in its home position above deck location 5. (If it is not, use the **Home XYZ** command in Bravo Diagnostics.)
2. Power off the Bravo.
3. Remove the pipette head from the packaging and place it in the stand to protect the barrels.

   !! DAMAGE HAZARD !! Never rest the bottom of the pipette head on a surface. This can damage the barrels.
4. Pull out and twist the two head-retainer pins one-quarter turn so that they remain retracted.

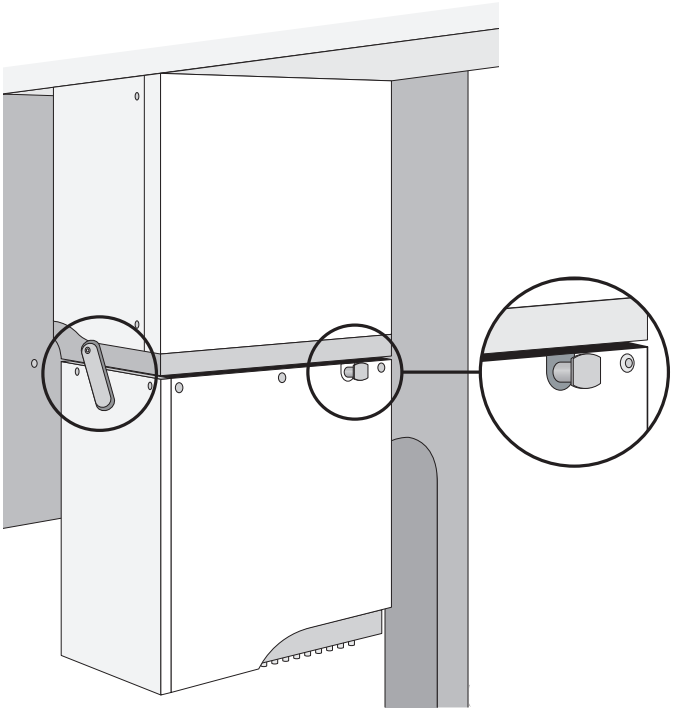
5. Slide the pipette head onto the head mount from left to right.



6. Rotate the head lock clockwise until it reaches its hard stop.

   This makes sure that the head is fully seated and does not shift position during operation.

7. Twist the two head-retainer pins so they snap in, securing the pipette head on the mount.



Related topics

For information about...	See...
The workflow this procedure belongs to	“Workflow for setting up the Bravo” on page 58
Homing the head mount	“Homing the pipette head” on page 88
The difference between Series II and Series III pipette heads	“The Bravo pipette heads” on page 18
Removing a pipette head	“Removing pipette heads” on page 146
The next step	“Turning on the Bravo” on page 63
Available pipette heads	“The Bravo pipette heads” on page 18
Location of power switch, head mount, and so on	“Hardware overview” on page 13
Controlling the pipette head.	“About Bravo Diagnostics” on page 82

Turning on the Bravo

About this topic

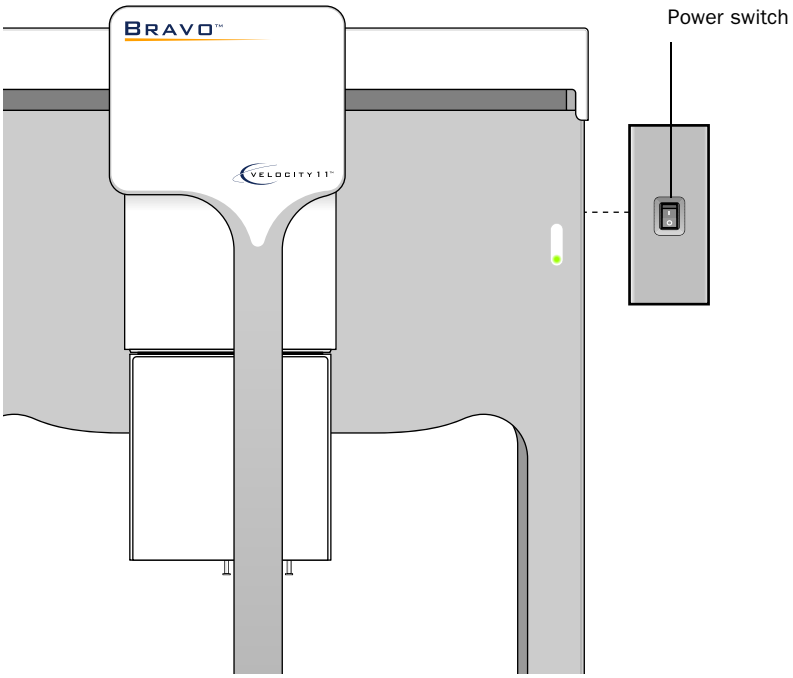
This topic describes how to turn on the Bravo.

Procedure

To turn on the Bravo:

1. Make sure that the main power line and Ethernet or serial cables are plugged into the connection panel.
2. Turn on the computer and log in to Windows.
3. On the side of the Bravo, press the power switch to the **on (|)** position.

   The green light on the switch is illuminated when the Bravo is on.



Related topics

For information about...	See...
Indicator lights	“Indicator lights” on page 17
The connection panel	“Connection panel description” on page 21
The workflow this procedure belongs to	“Workflow for setting up the Bravo” on page 58

Creating a profile for the Bravo

About this topic

This topic describes how to create a new profile for the Bravo.

About profiles

Profiles enable VWorks to:

- ❑ Identify and communicate with the Bravo
- ❑ Determine which pipette head is being used
- ❑ Store teachpoints and other registry file values

Every Bravo setup that requires different teachpoints requires a profile for that set of teachpoints. For example, if you add an accessory such as a Vacuum Filtration Station to the Bravo's deck, create a new profile that includes the new teachpoints for the MicroWash Reservoir.

Similarly, each pipette head requires a profile. If you move a pipette head from one Bravo to another, you need to create a new profile. You cannot use the same profile for different Bravo devices.

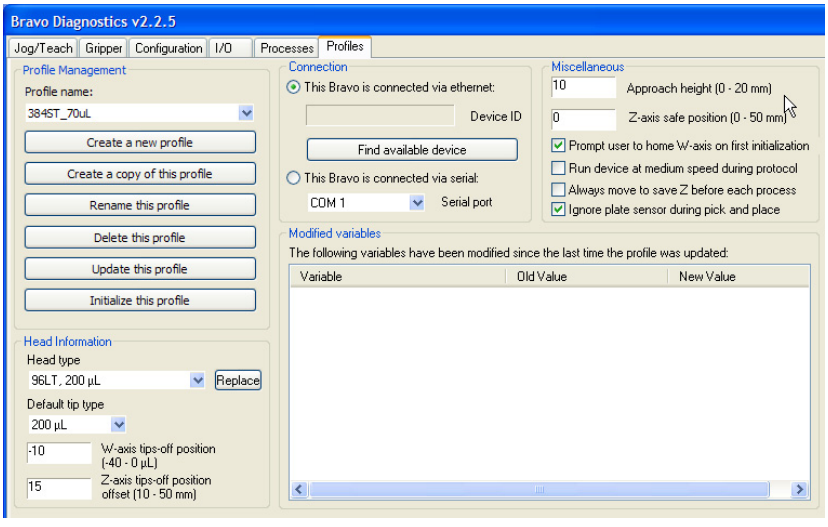
Before you start

Before you can create a profile, you have to open or create a device file.

Procedure

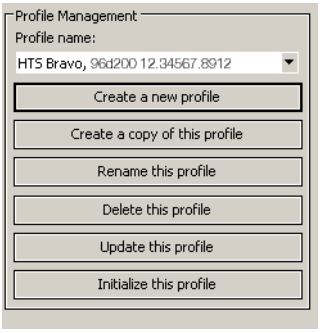
To create a new profile:

1. Make sure the device file is open.
2. Click **Device Diagnostics**.
3. Click the **Profiles** tab.

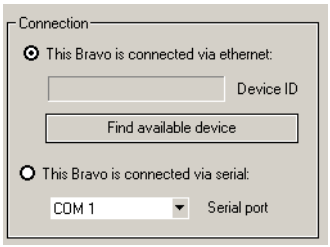


4. Click **Create a new profile**, enter a name and click **OK**.

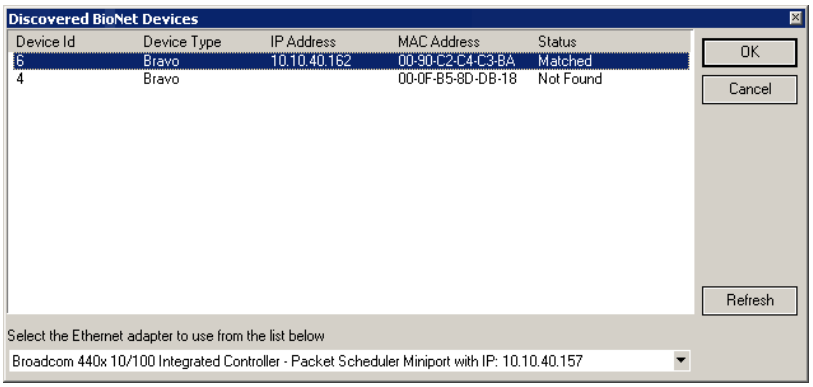
   Velocity11 highly recommends that you identify the name of the pipette head in the name you choose for the Bravo profile. For example, include the lab name, the head type, and the head's serial number in the profile name. If this computer controls multiple Bravos, also identify the device.



5. Set the **Connection** type:
   - Select Ethernet if your Bravo is connected to your computer with an Ethernet connection.
   - Select the **COM** port the connection is using if you have a serial connection.



6. If you selected an Ethernet connection, click **Find available device**.
7. In the **Discovered BioNet Devices** dialog box, select the Bravo and then click **OK**.

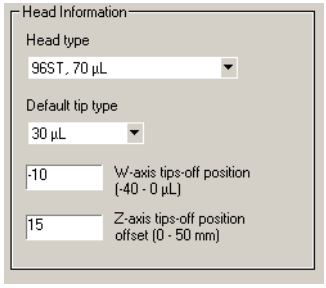


8. Configure the pipette head settings:
   a. Select the **Head type** from the list.
   b. If you selected a head type that uses disposable tips, select the **Default tip type** from the list. This is must be a Velocity11 brand tip.
   c. If you selected a disposable-tip head type, you can optionally change the *w*-axis and *z*-axis tips-off positions. However, the default values are adequate for most applications.

      The **W-axis tips-off position** is the *w*-axis position the pipette head moves to when ejecting the tips.

      The **Z-axis tips-off position offset** is the *z*-axis position the pipette head moves to when ejecting tips.

      Note: Click **Replace** only if you want to change the pipette head type. Follow the on-screen instructions for the replacement procedure.



9. *Optional.* Change the **Miscellaneous** settings to be applied during a protocol run. If you are unsure what values to set, use the default values. You can always change them later.

Miscellaneous settings	**Description**
Approach height	A safety margin about a plate. This is the *z*-axis distance or height above a plate that the tips move to before moving to another quadrant of the plate.
Z-axis safe position	The *z*-axis distance or height of the pipette head. A *z*-axis safe position of 0 is the highest position possible for the pipette head. A *z*-axis safe position of 10 means the pipette head is 10 mm below the highest point. If you select the Always move to safe Z before each process option, the Bravo moves to the *z*-axis safe height when moving between plate locations. Increasing this value may shorten run times by minimizing the z move between tasks. Making this value too large causes the pipette head to crash into labware when moving between plate locations.

Miscellaneous settings	Description
Prompt user to home W-axis on the first initialization	The warning displayed when the Bravo is initialized and before the *w*-axis is homed. This allows you to make sure that liquid is not unexpectedly dispensed from tips during the homing.
Run device at medium speed during protocol	The option to change the device speed to medium during a protocol run.
Always move to safe Z before each process	The option to move the pipette head to the specified *z*-axis safe position between processes. If you select this option, the Bravo moves to the specified *z*-axis safe height when moving between plate locations. Select this option if you have not specified the labware on the deck. If you do not select this option, the Bravo will automatically determine the safe z-axis point based on the labware specified, thereby optimizing the processing time. To prevent damage to the labware or the Bravo components, do not select this option if you have not specified the labware.
Ignore plate sensor during pick and place	The option to ignore the plate sensor during a pick-and-place movement. Select this option if the plate sensor is broken but you still want to test the pick-and-place function.

10. Click **Update this profile** to save the current selections and settings.
11. Click **Initialize this profile** to initiate communication to the Bravo using the new profile.

    The Bravo needs to be initialized before you edit teachpoints.

Related topics

For information about...	See...
The workflow this procedure belongs to	“Workflow for setting up the Bravo” on page 58
The next step	“Editing teachpoints” on page 68
Hardware components	“Hardware overview” on page 13
Opening diagnostics	“Opening Bravo Diagnostics” on page 83
What to do if the Bravo device does not appear in step 6	“Troubleshooting” on page 150

Editing teachpoints

About this topic

This topic describes how to check and edit a teachpoint.

Teachpoint defined

A teachpoint is a point in space that the pipette head moves to and is defined by a set of axial coordinates.

Each location on the Bravo deck has a default teachpoint that can be edited when necessary. The default teachpoints are set so that well A1 is the back-left corner well.

When to do this

You need to edit teachpoints when:

- ❑ You first set up your Bravo
- ❑ You add an accessory or an additional pipette head to the Bravo

Typically, these are procedures that you do once and then will not have to do again.

Before you start

If you are performing this procedure at a time other than initial setup, before you check and edit your teachpoints:

- ❑ Turn on your Bravo
- ❑ Log into VWorks
- ❑ Make sure you have the correct profile loaded and initialized

Editing a teachpoint

Follow this procedure to set or edit a teachpoint.

To edit a teachpoint:

1. Remove all labware from the deck locations.
2. Open the **Bravo Diagnostics** dialog box.
3. Click the **Jog/Teach** tab.
4. If you are using a pipette head with disposable tips, place a tip firmly on the head's barrel that corresponds to the A1 well of the labware you are using.

   Make sure the disposable tip is a Velocity11 tip and is the same type that you specified in the **Default tip type** field of the head's profile.
5. If you are using a fixed-tip head, set the teachpoint according to the A1 needle of the pipette head.

   Make sure the labware is installed in the correct orientation on the deck.
6. If setting up for the first time, select location 5 from the **Location** list, otherwise select the desired location, and click **Approach**.

7. Visually check the position of the pipette tip.

   It should be directly above the teachpoint (indicated by crosshairs on the A1 corner of the platepad) by the **Approach height** set in Bravo diagnostics (**Jog/Teach** tab).

8. Use the **Jog Axes** commands to move the pipette head to the correct teachpoint:

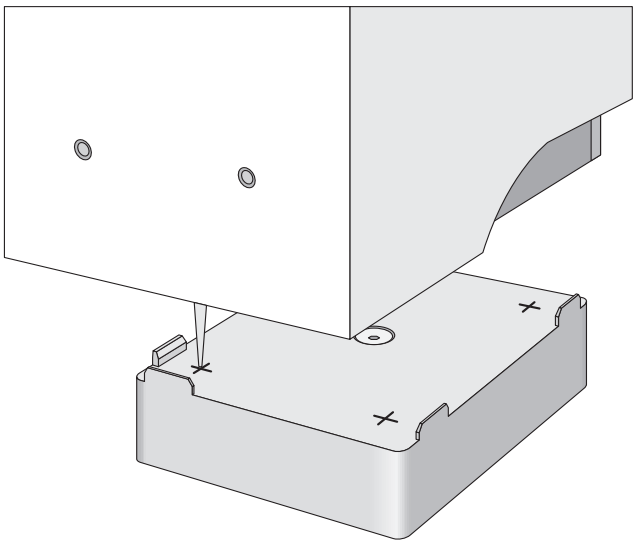
   a. Jog the pipette head down (*z*-axis) until it is approximately 2 mm above the platepad.

      Reduce the increment value when the tip gets close to the deck.

      !! DAMAGE HAZARD !! Especially for a fixed tip head, be careful not to jog down too far. Jogging down too far will damage the tip.

   b. Jog the pipette head in 0.05 mm increments in the *x* and *y* directions, targeting the crosshairs.

   c. Jog the pipette head in 0.05 mm increments in the *z* direction until the tip clears the platepad by about the thickness of a sheet of paper.



9. When the tip is in the correct position (directly over the crosshairs with paper-thin clearance), click **Teach**.

   Verify the information in the message box before you click **OK**.

10. To save the teachpoint, click the **Profiles** tab and click **Update this profile**.

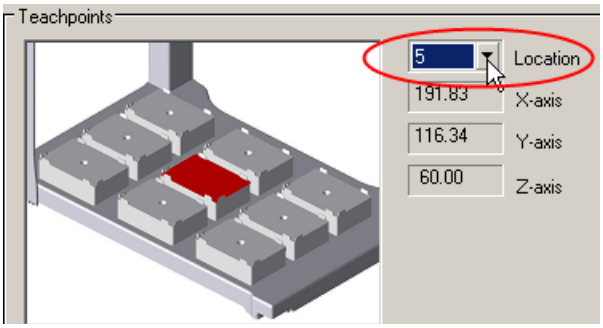
Setting other teachpoints based on one teachpoint

After setting a single teachpoint as described above, you can have VWorks calculate the other eight teachpoints based on the selected teachpoint. Typically, this is done upon initial set up of a new head.

!! IMPORTANT !! For optimal performance, teach each of the nine locations independently.

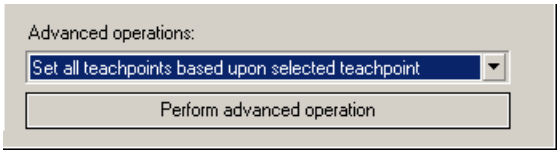
To set the other eight teachpoints:

1. On the **Jog/Teach** diagnostics page, make sure that the teachpoint you just taught (in the preceding topic) is set in the **Location** field.



   The teachpoint for the other locations will be set based on this one.

2. In the **Advanced operations** area of the **Jog/Teach** tab, select **Set all teachpoints based upon selected teachpoint**.



3. Click **Perform advanced operation**.

   VWorks calculates the teachpoints for the other eight locations, keeping the *z*-axis coordinate the same and changing the *x* and *y* coordinates according to their spacing.

4. To save the teachpoints, click the **Profiles** tab and click **Update this profile**.

Setting teachpoints for accessory locations

If your Bravo's deck has any accessories such as the Weigh Station or a Vacuum Filtration Station, you need to set teachpoints for these individually.

!! DAMAGE HAZARD !! If you selected the Set all in the Advanced operations list, make sure you always teach the platepads first. Otherwise, you might accidentally overwrite the accessory teachpoint.

!! DAMAGE HAZARD !! If you selected Set all teachpoints based on current teachpoint in the Advanced operations list, be sure to start the teaching process from the safe z-axis point above the accessory location. This prevents the pipette head from crashing into the accessory.

To set teachpoints for accessories:

Follow the instructions in "Editing a teachpoint" on page 68. Be sure to set the **Location** field to the location of the accessory.

Verifying teachpoints

After setting and saving teachpoints, it is good practice to verify each teachpoint.

To verify a teachpoint:

1. On the **Jog/Teach** diagnostics tab, set the **Location** field to the location you want to check.
2. Click **Approach**.
3. Use this table to decide your next step.

If the tip is...	Then...
Above the crosshairs at the approach height	a. Click **Move** to move the tip to the teachpoint. b. Visually check the position of the pipette tip. It should be directly over the crosshairs with a clearance of about the thickness of a sheet of paper. (If it is not, repeat "Editing a teachpoint" on page 68.)
Not above the crosshairs or appears to be closer to the deck than the approach height	There is a problem with the teachpoint. Repeat "Editing a teachpoint" on page 68.

4. Repeat the above steps for each teachpoint.

Related topics

For information about	See...
The workflow this procedure belongs to	"Workflow for setting up the Bravo" on page 58
Opening Diagnostics	"Opening Bravo Diagnostics" on page 83
Initializing a profile	"Creating a profile for the Bravo" on page 64 (step 11)
Changing the pipette head	"Removing pipette heads" on page 146
The Jog/Teach diagnostics tab	"About the Jog/Teach tab" on page 85
Approach and Move commands	"Using the Move and Approach commands" on page 94

Performing a run

5

This chapter describes how to prepare for and run an existing protocol on the Bravo. The procedures in this chapter can be performed by someone with operator privileges.

This chapter contains the following topics:

- ❑ "Workflow for performing a run" on page 74
- ❑ "Preparing the Bravo for a run" on page 75
- ❑ "Stopping the Bravo in an emergency" on page 77
- ❑ "Cleaning up after a run" on page 78
- ❑ "Shutting down the Bravo" on page 79

Workflow for performing a run

About this topic

This topic tells you where to find the information about starting a run and performing tasks associated with running a protocol.

Workflow

Step	Topic	See...
1	Preparing the Bravo for a run	"Preparing the Bravo for a run" on page 75
2	Starting a run from VWorks	*VWorks User Guide*
3	Monitoring a run	*VWorks User Guide*
4	Pausing or stopping a run	*VWorks User Guide*
5	Clean up	"Cleaning up after a run" on page 78

Preparing the Bravo for a run

About this topic

This topic explains how to prepare the Bravo for a run.

Run description

A run is a single protocol that is performed one or more times in a series.

Before you start

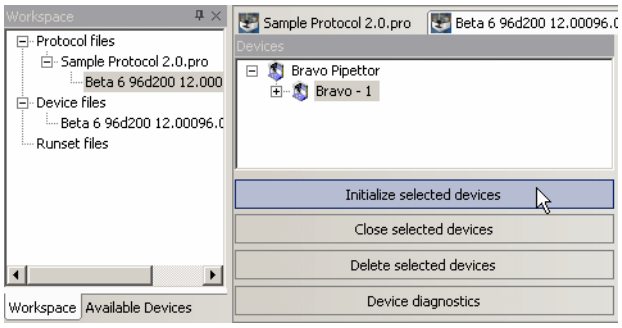
Make sure:

- ❑ The Bravo is turned on.
- ❑ The VWorks software is set up.

Procedure

To prepare the Bravo for a run:

1. Make sure the correct pipette head is installed.
2. Initialize the Bravo:
   a. In the **Workspace** toolbar, select the device file you are using.
   b. Make sure the Bravo is selected in the **Devices** list.
   c. Click **Initialize selected devices**.



3. Place plates, tip boxes, and other labware in their correct locations on the Bravo deck.

   To avoid variability problems, use only Velocity11 brand tips.
4. If you are using an accessory, such as a Pump Module or Weigh Station, make sure the reservoirs are filled, the waste bottles are empty, and all tubing is correctly connected.
5. Empty the Tip Trash, if installed.
6. Compile the protocol.
7. Run the protocol in simulation mode.

Related topics

For information about...	See...
Installing and setting up Bravo	❑ "Installing the Bravo" on page 25 ❑ "Setting up the Bravo" on page 57
Installing, setting up, and running VWorks	*VWorks User Guide*
Initializing the Bravo	"Installing a pipette head" on page 147
Changing the pipette head	❑ "Removing pipette heads" on page 146 ❑ "Mounting the pipette head" on page 59
The workflow this procedure belongs to	"Workflow for performing a run" on page 74

Stopping the Bravo in an emergency

About this topic

This topic describes when and how to stop the Bravo while it is in operation.

Use this procedure to:

- ❑ Abort a pipette head movement immediately
- ❑ Abort a run in an emergency situation

Do not use this procedure to pause and continue a run. If the stop button is pressed while the pipette head is aspirating or dispensing, the pipetting accuracy might be impaired. If you want to pause and then continue a run, use the Pause button in VWorks.

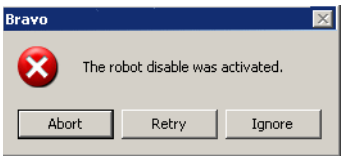
Procedure

To stop the pipette head motion:

1. Press the red button on the pendant.

   This disables the Bravo's motors, causing all motion to stop.
2. Release the disable button by turning it clockwise.
3. In the message box, click one of the action buttons to re-enable the motors in the head.

   Note: Pressing the go button on the pendant will not re-activate the pipette head.



If you want to...	Then click...
Abort execution of the command or task	Abort
Attempt re-execution of the command or task	Retry
Ignore the current command or task and proceed to the next command or task	Ignore

Related topics

For information about...	See...
Pausing and continuing a run	*VWorks User Guide*
Using the go button on the pendant	*VWorks User Guide*

Cleaning up after a run

About this topic

This topic describes the tasks you should perform when you have finished a protocol run.

Procedure

To clean up after a run:

1. Remove manually placed plates from platepads.
2. Wash items such as reservoirs, tubes, and manifolds that were contacted by liquid.
3. Clean the deck of any spills or debris.
4. If necessary, use Bravo Diagnostics to remove pipette tips.
5. Check run logs for errors.
6. If you have administrator or technician privileges and you have modified the protocol, including selected options, you can save the protocol.
7. Log out of VWorks.
8. Optionally, shut down the Bravo.

Related topics

For information about...	See...
Running logs	*VWorks User Guide*
Saving protocols	*VWorks User Guide*
Using the Log toolbar	*VWorks User Guide*
Shutting down	“Shutting down the Bravo” on page 79

Shutting down the Bravo

About this topic

This topic describes when and how to shut down the Bravo.

When to shut down

Shut down the Bravo if you intend to:

- ❑ Move it
- ❑ Leave it unused overnight

Procedure

To shut down the Bravo:

1. Make sure that the post-run clean up procedure was followed after the last run.
2. Optionally, home the pipette head.
3. Select **File** > **Exit** to shut down VWorks.
4. Turn off and remove any accessories, for example, Pump Modules.
5. If using an Auto Filling Reservoir, disconnect bottles to prevent siphoning.
6. Turn the main power switch to the off position.
7. Turn the power off on any accessory installed with the Bravo.

Related topics

For information about...	See...
Cleaning up after a run	“Cleaning up after a run” on page 78
Power connections	“Connection panel description” on page 21
Homing the pipette head	“Homing the pipette head” on page 88
Turning off and removing Bravo accessories	“Bravo accessories” on page 109

Using Bravo Diagnostics

6

This chapter explains how to use the Bravo Diagnostics software to control the Bravo.

Velocity11 recommends that only administrators and experienced personnel use the procedures in this chapter to diagnose errors with the Bravo.

This chapter contains the following topics:

- ❑ "About Bravo Diagnostics" on page 82
- ❑ "Opening Bravo Diagnostics" on page 83
- ❑ "About the Jog/Teach tab" on page 85
- ❑ "Homing the pipette head" on page 88
- ❑ "Moving the pipette head manually" on page 90
- ❑ "Jogging the pipette head" on page 91
- ❑ "Changing the pipette head speed" on page 93
- ❑ "Using the Move and Approach commands" on page 94
- ❑ "Configuring an accessory" on page 96
- ❑ "Fine-tuning the gripper movements" on page 99
- ❑ "Clearing motor faults and checking the head type" on page 104
- ❑ "Performing commands using Bravo Diagnostics" on page 105
- ❑ "Managing profiles" on page 107

About Bravo Diagnostics

About this topic

This topic briefly describes the uses of Bravo Diagnostics.

Description

Diagnostics software is used to:

- ❑ *Create profiles.* These are files that contain communication, head type, and teachpoint settings that VWorks uses to execute protocols. The profiles also store the Configure Deck Location information. At least one profile is required for each head type used on the Bravo.
- ❑ *Set teachpoints*. These are instructions that tell the pipette heads exactly where to move with a particular piece of labware to perform a task.
- ❑ *Configure plate locations.* These are settings specific to a plate location accessory. For example, if you have a Pump Module installed, this is where you set the flow directions.
- ❑ *Execute individual tasks.* Unlike in a protocol where commands are scheduled to execute in the future, in diagnostics commands are carried out immediately. Executing individual processes is useful for working out parameters for a protocol, doing one-time operations, and troubleshooting.

Types of diagnostics software

Other devices manufactured by Velocity11 include their own diagnostics software. You can find instructions for using this software in the relevant user guide.

Related topics

For information about...	See...
Setting teachpoints	"Editing teachpoints" on page 68
Performing real-time operations	"Performing commands using Bravo Diagnostics" on page 105
Creating and editing profiles	❑ *VWorks User Guide* ❑ "Creating a profile for the Bravo" on page 64 ❑ "Managing profiles" on page 107
Opening diagnostics	"Opening Bravo Diagnostics" on page 83

Opening Bravo Diagnostics

About this topic

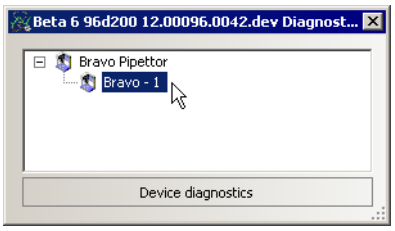
This topic describes two equivalent procedures for opening Bravo Diagnostics.

Procedure 1

To open Bravo Diagnostics:

1. Click **Diagnostics** on the Control toolbar.

2. In the device file's window, select the Bravo.



3. Click **Device diagnostics** located at the bottom of the window.

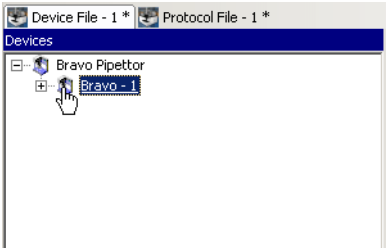
   The Bravo's diagnostics dialog box opens.

Procedure 2

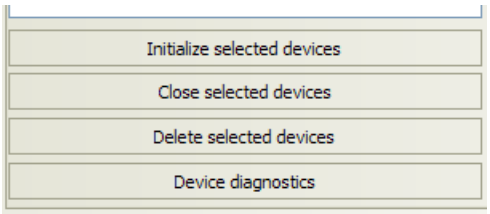
To open Bravo Diagnostics:

1. Click the **Device File** tab.
2. Select the Bravo from the **Devices** toolbar.

   Expand the general name of the device, if necessary.



3. Click **Device diagnostics** located at the bottom of the **Devices** toolbar.



   The Bravo's diagnostics dialog box opens.

Related topics

For information about...	See...
Diagnostics	"About Bravo Diagnostics" on page 82
Jog/Teach tab	"About the Jog/Teach tab" on page 85
IO/Configuration tab	"Configuring an accessory" on page 96
Tasks tab	"Performing commands using Bravo Diagnostics" on page 105
Profiles tab	❑ *VWorks User Guide* ❑ "Creating a profile for the Bravo" on page 64 ❑ "Managing profiles" on page 107

About the Jog/Teach tab

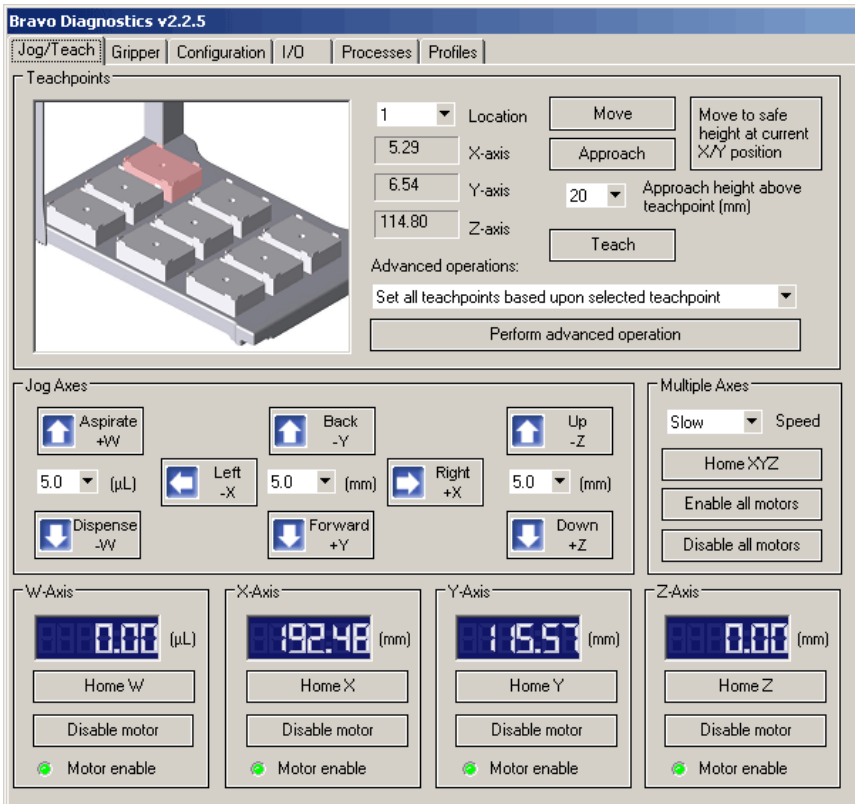
About this topic

This topic briefly describes the features of the Jog/Teach diagnostics tab.

Contents of the Jog/Teach tab

The Jog/Teach tab allows you to:

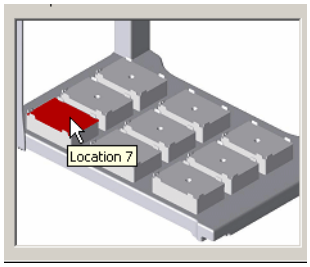
- ❑ Control the Bravo's motion
- ❑ Edit teachpoints
- ❑ Home the pipette head and adjust its speed while in diagnostics
- ❑ Move the pipette head incrementally in each of its axes
- ❑ View real-time location of each axis



The Bravo visual display

The Bravo display provides a visual way to control the Bravo and monitor the pipette head's movement. The highlighted plate location indicates the location of the pipette head. You can move the head in real time by right-clicking a location and selecting a command. Rest the pointer on a location to display the deck location number.

Typically, the display is used for moving the pipette head and defining teachpoints.



Pipette head control procedures

The following are procedures you can perform from the Jog/Teach tab:

Procedure	See...
Home the pipette head	"Homing the pipette head" on page 88
Disable all pipette head motors	"Moving the pipette head manually" on page 90
Edit teachpoints	"Editing teachpoints" on page 68
Change the speed of the pipette head	"Changing the pipette head speed" on page 93
Jog the pipette head	"Jogging the pipette head" on page 91

Pipette head axes

You can control the pipette head's movement in four directions:

Axis	Description
X	The horizontal distance (left-to-right) in millimeters, along the rail from the *x*-axis home position.
Y	The horizontal distance (front-to-back), in millimeters, along the rail from the *y*-axis home position.
Z	The vertical distance, in millimeters, from the *z*-axis home position.
W	The vertical distance, in microliters, from the *w*-axis home position.

Related topics

For information about...	See...
Diagnostics	"About Bravo Diagnostics" on page 82
Opening diagnostics	"Opening Bravo Diagnostics" on page 83
IO/Configuration tab	"Configuring an accessory" on page 96
Tasks tab	"Performing commands using Bravo Diagnostics" on page 105
Profiles tab	❑ *VWorks User Guide* ❑ "Creating a profile for the Bravo" on page 64 ❑ "Managing profiles" on page 107
The four axes of the Bravo instrument	"Hardware overview" on page 13

Homing the pipette head

About this topic

This topic describes when and how to home the pipette head.

About homing and sending home

Homing

The pipette head has a defined home position for each axis of motion. Homing sends the pipette head to the home position for the axes. Home the pipette head to reset the axes. For example, if you notice the Bravo is not moving to locations or teachpoints accurately, home the pipette head.

Homing the pipette head is typically done automatically on first initialization after startup.

Sending home

Move the pipette head home when you want to move it to a safe position or out of the way.

There are four homing axes.

Homing in this axis...	Moves the...
X	Pipette head to its home position in the horizontal (left-right) axis. This position is near the middle of the *x*-axis range.
Y	Pipette head to its home position for the horizontal (forward-backward) axis. This position is near the middle of the *y*-axis range.
Z	Pipette head to its home position in the vertical (up-down) axis. This position is near the top of the *z*-axis range.
W	Internal pipette head to its home position in the vertical aspirate-dispense axis. This position is near the low-to-mid *w*-axis range.

Homing the pipette head

!! INJURY HAZARD !! Keep away from the Bravo when the pipette head is moving or about to move, especially in the *z*-axis direction. The pipette head's *z*-axis motor is particularly powerful. It might not stop immediately in a collision and a pipette tip could pierce your hand.

To home the pipette head:

1. Open the **Bravo Diagnostics** dialog box and click the **Jog/Teach** tab.
2. To home the pipette head for all axes, click **Home XYZ**.

   The pipette head homes.

   The axis order of homing is *z*—> *x*—> y.

You can also home the pipette head in a single axis by clicking Home axis.

!! DAMAGE HAZARD !! Make sure you home the *z*-axis first so that the pipette head avoids the labware.

Related topics

For information about...	See...
Opening diagnostics	“Opening Bravo Diagnostics” on page 83
Changing the pipette head	“Removing pipette heads” on page 146

Moving the pipette head manually

About this topic

This topic describes how to move the pipette head in manual mode. You can move the pipette head manually in the *x*-axis and *y*-axis, but first you must disable all servo motors.

Move the pipette head manually when you want to position the pipette head by eye where you want. This is useful when you are creating a new teachpoint.

For example, you could move the pipette head to the general location and then use jogging to refine the position.

Procedure

To move the pipette head manually:

1. Press the red button on the pendant.

   This disables the Bravo's motors so that it is safe to move the pipette head by hand.

   !! DAMAGE HAZARD !! Moving the pipette head in any of its axes without first disabling the servos could damage the pipette head's motors.
2. Move the pipette head's *x*-axis and *y*-axis manually.
3. When you are finished moving the pipette head, release the disable button by turning it clockwise.

Related topics

For information about...	See...
Teachpoints	"Editing teachpoints" on page 68
Opening diagnostics	"Opening Bravo Diagnostics" on page 83
Setting up the Bravo	"Workflow for setting up the Bravo" on page 58
Moving the pipette head using diagnostics software	"Jogging the pipette head" on page 91

Jogging the pipette head

About this topic

Jog the pipette head when you need to move it in small increments. You can jog the pipette head in the *x*-axis, *y*-axis, *z*-axis, or *w*-axis.

Jogging is useful when creating teachpoints. For example, you could move the pipette head manually to a position you want to set as a teachpoint. After you have re-enabled the pipette head's servos, you can fine-tune the pipette head's position by jogging it.

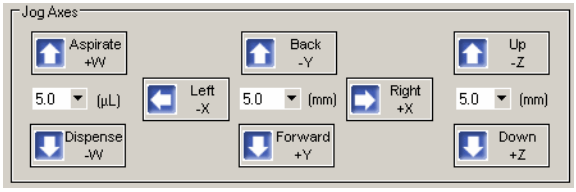
!! DAMAGE HAZARD !! To prevent damage to the gripper and other hardware components, do not dock the gripper if you want to jog the pipette head along the *y*-axis and *z*-axis.

Jogging the pipette head

!! DAMAGE HAZARD !! Before you jog the pipette head, remove objects from the pipette head's path. Move the pipette head slowly and keep the jog increment small until you are certain that there is no obstruction.

To jog the pipette head:

1. Open **Bravo Diagnostics** dialog box and click the **Jog/Teach** tab.
2. Select the jog increments in the appropriate list.



3. Click a direction button to move the pipette head.
4. Monitor the current position of the pipette head by checking the number in the axes display screens or in the text fields under the **Location** list. This shows the number of millimeters the pipette head is from the home position.

   !! INJURY HAZARD !! Keep away from the Bravo when the pipette head is moving or about to move, especially in the *z*-axis direction. The pipette head's *z*-axis motor is particularly powerful. It might not stop immediately in a collision and a pipette tip could pierce your hand.

Related topics

For information about...	See...
Teachpoints	“Editing teachpoints” on page 68
Opening diagnostics	“Opening Bravo Diagnostics” on page 83
Jog/Teach tab	“About the Jog/Teach tab” on page 85
Setting up the Bravo	“Workflow for setting up the Bravo” on page 58

Changing the pipette head speed

About this topic

You can change the pipette head speed when creating new teachpoints or troubleshooting a problem.

This topic describes how to change the pipette head speed in Bravo diagnostics.

Procedure

This procedure describes how to change the speed that the pipette head moves in the *x*-axis, *y*-axis, and *z*-axis while in diagnostics.

To change the pipette head speed:

1. Open **Bravo Diagnostics** dialog box and click the **Jog/Teach** tab.
2. In the **Speed** list, select one of the following:
   - Slow
   - Medium
   - Fast

3. Click **OK** at the bottom of the **Jog/Teach** tab for the changes to take effect.

Related topics

For information about...	See...
Opening diagnostics	“Opening Bravo Diagnostics” on page 83
Editing a teachpoint	“Editing teachpoints” on page 68
Setting up the Bravo	“Workflow for setting up the Bravo” on page 58

Using the Move and Approach commands

About this topic

The Bravo Move and Approach commands let you quickly move the pipette head to any of nine locations on the deck.

Typically, these commands are used when editing teachpoints. This topic describes how to move to and approach locations on the Bravo deck using these commands.

Commands defined

The Move command instructs the pipette head to move to the teachpoint for the selected location.

The Approach command instructs the pipette head to move to the teachpoint for the selected location, with a vertical offset equal to the Approach Height for the selected location. This is the height above the teachpoint and is different than the Approach Height set in the profile. The Approach Height in the profile is the height above the labware when pipetting.

!! DAMAGE HAZARD !! Make sure the pipette head is clear of any obstacles that you have not defined. VWorks will display a dialog box warning you of a possible collision if the requested movement overlaps a known teachpoint. The Move-to-Position commands present a higher damage risk to the pipette head, because you command it to move in large increments.

Before you start

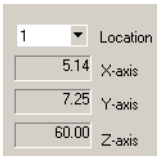
Make sure there is no labware on the Bravo deck and that the pipette head has been taught with the same type of tips used in the profile.

Procedure

To use the Move command:

1. Open Bravo **Diagnostics** dialog box and click the **Jog/Teach** tab.
2. Select a location from the **Location** list box.

   Locations correspond to the nine available on the deck.



3. Click **Move**.

   !! INJURY HAZARD !! Before you command the pipette head to move, make sure everyone is clear of the Bravo and there are no obstacles on the deck.

   The pipette head moves to the selected location's teachpoint.

To use the Approach command:

1. Repeat step 1 and step 2 from the above procedure.
2. If necessary, change the **Approach height above teachpoint** value.
3. Click **Approach**.

   !! INJURY HAZARD !! Before you command the pipette head to move, make sure everyone is clear of the Bravo and there are no obstacles on the deck.

   The pipette head moves to the selected location's approach height.

Related topics

For information about...	See...
Editing teachpoints	"Editing teachpoints" on page 68
Setting up the Bravo	"Workflow for setting up the Bravo" on page 58
Opening diagnostics	"Opening Bravo Diagnostics" on page 83

Configuring an accessory

About this topic

This topic explains how to configure an accessory using the Configuration tab in Bravo Diagnostics.

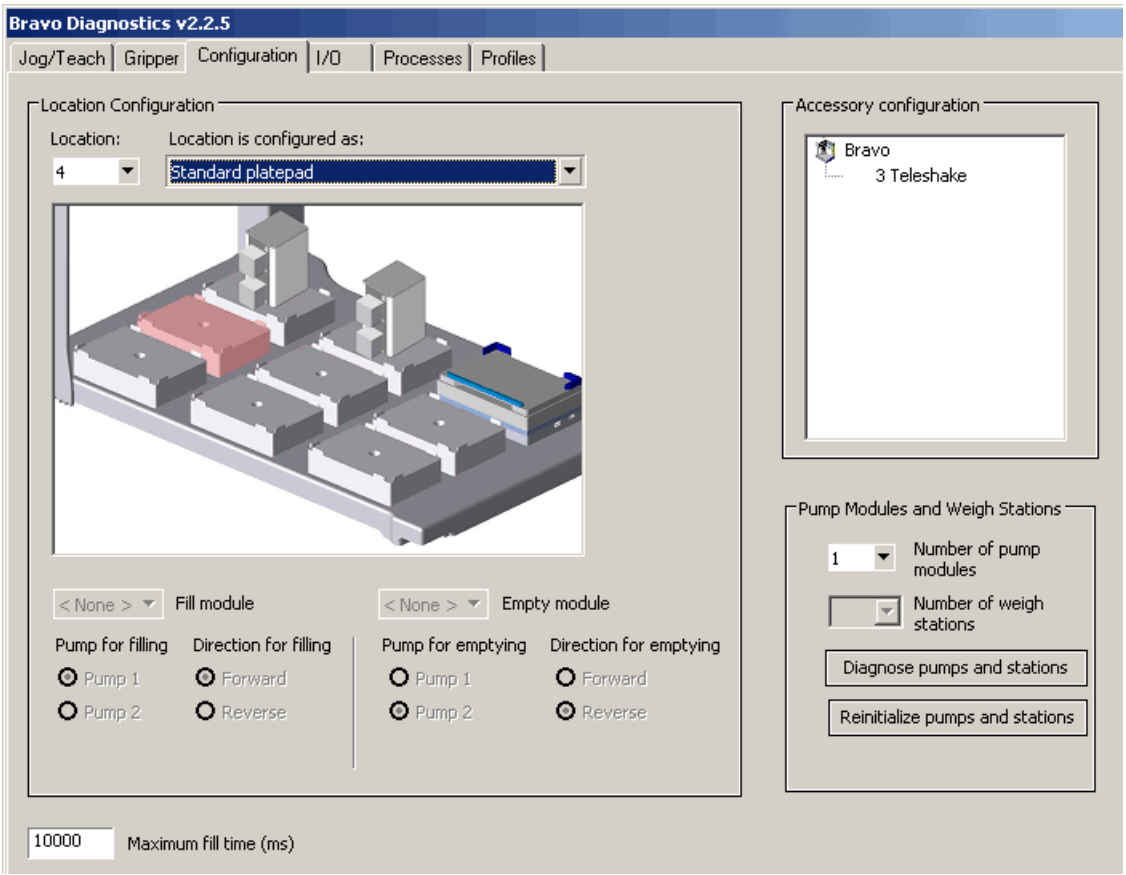
Accessories that require configuring

If you installed one of the following accessories, you must configure it in VWorks so that the software can control its functions during a run.

- ❑ Auto Filling Reservoir (requires Pump Module)
- ❑ MicroWash Reservoir (requires Pump Module)
- ❑ Orbital Shaker (Teleshake)
- ❑ Vacuum Filtration Station
- ❑ Weigh Station (requires Pump Module)

Note that you are required to specify the Pump Module when you configure the Auto Filling Reservoir, MicroWash Reservoir, and Weigh Station.

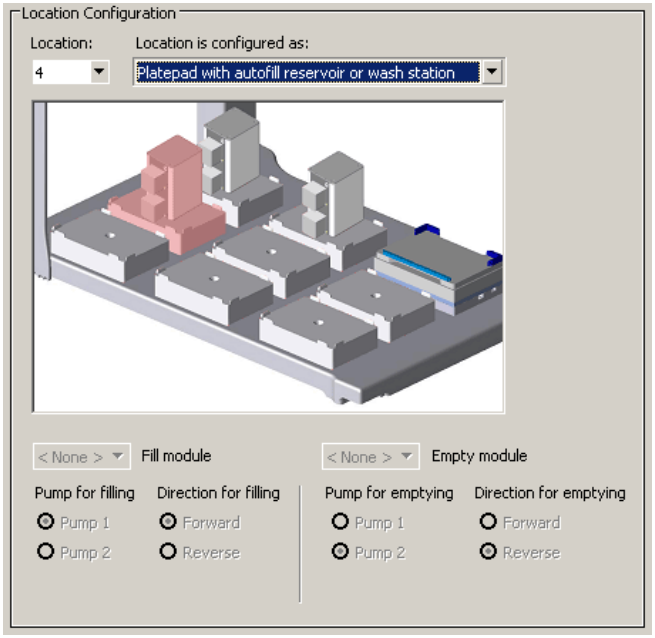
You use the Configuration tab in Bravo Diagnostics to configure an accessory.



Configuring an Auto Filling Reservoir, MicroWash Reservoir, or Weigh Station

To configure an Auto Filling Reservoir, MicroWash Reservoir, or Weigh Station:

1. Open **Bravo Diagnostics** and click the **Configuration** tab.
2. Specify the deck location on which the accessory is installed:
   - Click the location in the visual display or,
   - Select the location from the **Location** list.
3. In the **Location is configured as** list, select one of the following:
   - **Platepad with autofill...** for the Auto Filling Reservoir and MicroWash Reservoir
   - **Platepad with Weigh Station** for Weigh Station



4. Select the number of Pump Modules you have connected to the Bravo from the list.

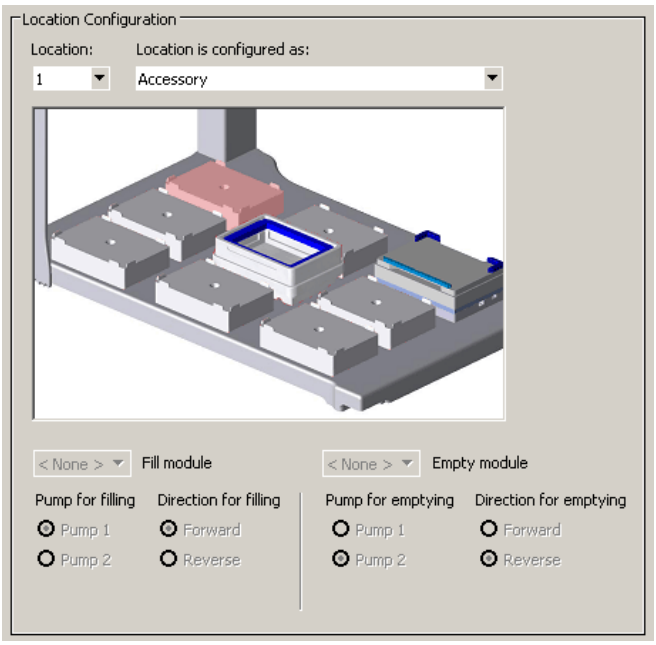
   Even though each Pump Module has two pumps, this number refers to the number of complete modules you have connected.
5. Set the **Autofill pump module** settings:
   a. Select which pump on the module you want to use for filling.
   b. Select the direction in which the pump must go for filling.
6. Set the **Autoempty pump module** settings:
   a. Select which pump on the module you want to use for emptying.
   b. Select the direction in which the pump must go for emptying.

Note: If you need to operate the pump through the Pump Module diagnostics, click **Diagnose devices at chosen location**.

Configuring an Orbital Shaker (Teleshake) and Vacuum Filtration Station

To configure an Orbital Shaker (Teleshake) or Vacuum Filtration Station:

1. Open **Bravo Diagnostics** and click the **Configuration** tab.
2. Specify the deck location on which the accessory is installed:
   - Click the location in the visual display or,
   - Select the location from the **Location** list.



3. In the **Location configured as** list, select **Accessory**.

   The Accessories Wizard dialog box opens.
4. Follow the instructions in the Accessories Wizard dialog box to specify a deck location, select **Teleshake** (Orbital Shaker) or **Vacuum Filtration Station,** and specify the means to communicate with and control the accessory.

Related topics

For information about...	See...
Bravo accessories	“Bravo accessories” on page 109
Editing teachpoints	“Editing teachpoints” on page 68
Setting up the Bravo	“Workflow for setting up the Bravo” on page 58
Opening diagnostics	“Opening Bravo Diagnostics” on page 83

Fine-tuning the gripper movements

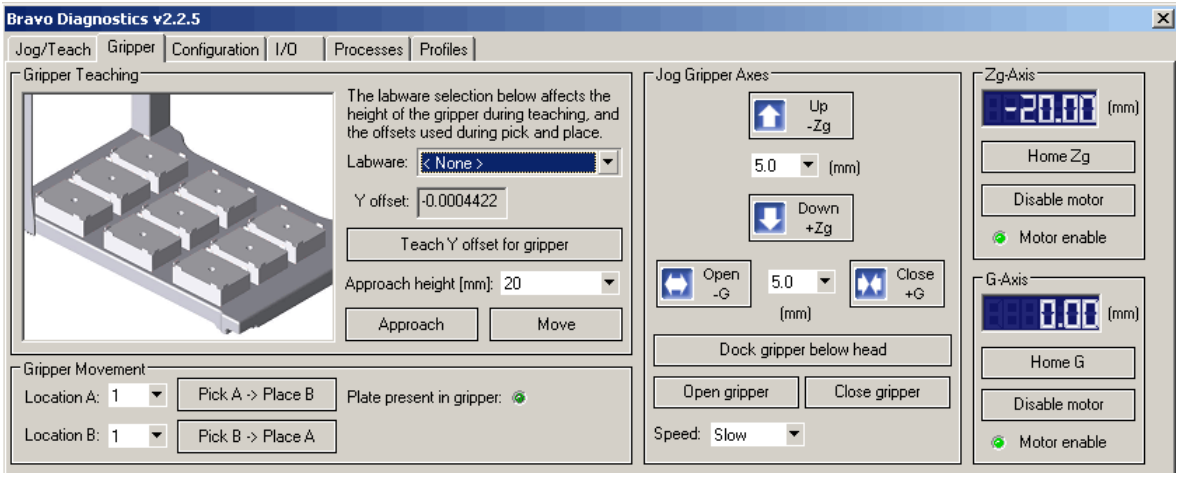
About this topic

This topic describes how to fine-tune gripper movements using the Gripper tab in the Bravo Diagnostics. This topic applies only to Bravos that have the gripper.

About the Gripper tab

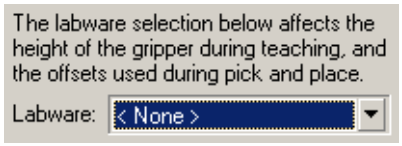
Under normal operating conditions, you do not need to adjust the gripper. If you are troubleshooting the gripper or verifying teachpoints, you can use the Gripper tab of the Bravo Diagnostics to:

- ❑ Specify the labware when editing teachpoints
- ❑ Adjust the *y*-axis offset, in case further fine-tuning is necessary if you replace the gripper assembly
- ❑ Use the Move and Approach commands
- ❑ Verify that the gripper is able to pick up and place labware based on specified deck locations
- ❑ Incrementally jog the gripper on the G-axis (opening and closing distance) and the *Zg*-axis (vertical distance)
- ❑ Verify that the gripper is able to open and close
- ❑ Change the gripper speed
- ❑ Home the gripper
- ❑ Dock the gripper below the pipette head
- ❑ Disable the gripper motors
- ❑ Verify that the plate sensor is working



Specifying the labware

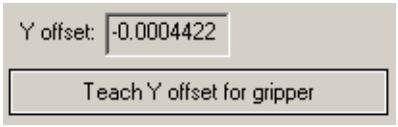
When you want to run pickup and placement trials, you should specify the labware that you want to use for the trial. To do this, in the **Gripper Teaching** area, select the desired labware in the **Labware** list.


The labware selection below affects the height of the gripper during teaching, and the offsets used during pick and place.
Labware:
< None >

Adjusting the y-axis offset

Under normal operating conditions, the Bravo is able to predetermine offset distances based on the pipette head selection and other settings. You do not need to make further adjustments. However, if you are troubleshooting and want to fine-tune the *y*-axis offset, jog to the desired Y offset position. Click **Teach Y offset for gripper** to save the new offset value.

For example, if you are changing pipette head types and find that the new teachpoint is not at the center of the plate, you can provide a new *y*-axis offset value to move the teachpoint to the center of the plate.



Using the Move and Approach commands

The gripper Move and Approach commands are used when verifying teachpoints. In the Gripper Teaching area:

- Click **Move** to quickly move the pipette head to a teachpoint above a selected deck location and lower the gripper to the surface of the platepad.
- Select the **Approach height (mm)**, and then click **Approach** to lower the gripper to the approach (offset) height. The offset height is the distance above the teachpoint.

Picking up and moving labware

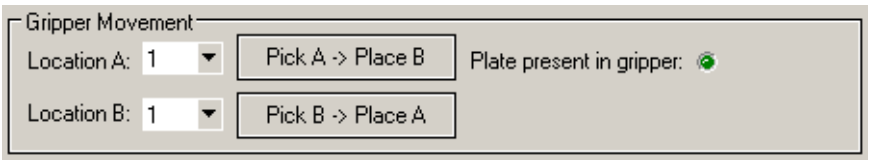
To verify that the gripper is able to pick up and place labware, in the **Gripper Movement** area:

- In the **Location A** list, select a deck location.
- In the **Location B** list, select a deck location.

Place a test plate on either deck location A or B, and then click one of the following:

- **Pick A -> B** to pick up the plate from deck location A and place it on deck location B.
- **Pick B -> A** to pick up the plate from deck location B and place it on deck location A.

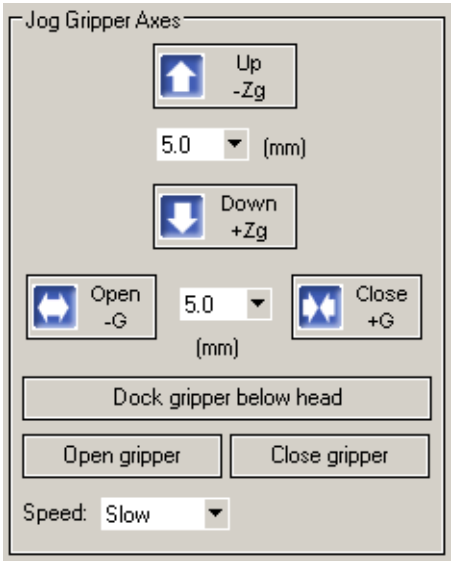
Check the **Plate present in gripper** indicator light to make sure the gripper picked up the plate as specified.



Jogging the gripper

Before you edit teachpoints, you can jog the gripper on the G-axis (opening and closing distance) and the *Zg*-axis (vertical distance). To do this:

1. In the **Jog Gripper Axes** area, specify the distance you want to jog in millimeters.
2. Click the direction button to move the gripper.
3. In the **Zg-Axis** and **G-Axis** areas, check the new distance from the home position.



Opening and closing the gripper

To verify that the gripper is able to open and close properly, in the **Jog Gripper Axes** area, click **Open gripper** and **Close gripper.** Watch the gripper movement as you do so.

Changing the gripper speed

Under normal operating conditions, you do not need to change the gripper speed. However, for troubleshooting purposes, you might want to change the speed when you check other gripper functions.

To set the gripper speed, in the **Jog Gripper Axes** area, select the desired speed (Slow, Medium, or Fast) in the **Speed** list.

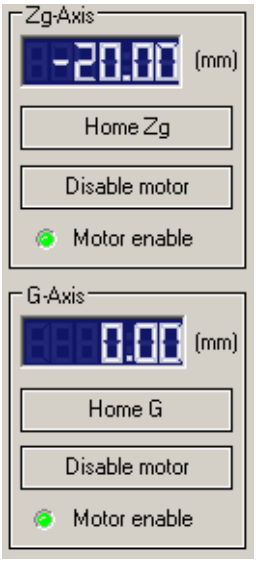
Note: The speed setting does not apply to the closing grip action.

Homing the gripper

The gripper has a defined home position for each axis of its motion. Homing sends the gripper to the home position of the axes.

Homing the gripper is done automatically during startup. However, you might want to home the gripper during troubleshooting processes.

To home the gripper, in the **Zg-axis** or **G-axis** areas, click **Home Zg** or **Home G.** The gripper moves to the predefined position on the corresponding axis.

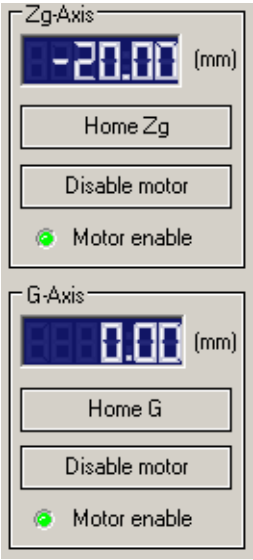


Docking the gripper

During troubleshooting or verification procedures, you might want to dock the gripper so that it rests in the recess of the Series III pipette head or under the Series II pipette head. To dock the gripper, in the **Jog Gripper Axes** area, click **Dock gripper below head.** The gripper moves upward and rests in the recess under the pipette head.

Disabling the gripper motors

You can turn off the gripper motor that operates in either the *Zg*-axis (vertical direction) or the *G*-axis (opening-closing direction). To disable the gripper motors, in the **Zg-Axis** or **G-Axis** areas, click **Disable Motor.**



Related topics

For information about...	See...
Bravo accessories	“Bravo accessories” on page 109
How to configure an accessory	“Configuring an accessory” on page 96
Editing teachpoints	“Editing teachpoints” on page 68
Setting up the Bravo	“Workflow for setting up the Bravo” on page 58
Opening diagnostics	“Opening Bravo Diagnostics” on page 83

Clearing motor faults and checking the head type

About this topic

This topic describes how to clear motor faults and check the head type.

Clearing motor faults

Occasionally, during use, an error might occur that results in either disabling the pipette head movement or the pipette head motor. When this occurs:

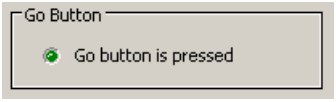
1. Open **Bravo Diagnostics** and click the **I/O** tab.
2. Click **Clear motor power fault** to restore the power and pipette head function.
3. If step 2 does not clear the faults, power cycle the Bravo to ensure proper function.

Head present indicator

If a pipette head is mounted to the Bravo, the **Head present** indicator lights and the **Head type** that is detected by VWorks is displayed.

Go Button

The Go button on the pendant should be linked to the indicator in VWorks. When the Go button on the pendant is pressed, the **Go button is pressed** indicator in VWorks lights up.



Related topics

For information about...	See...
Defining labware	*VWorks User Guide*
Setting up the Bravo	"Setting up the Bravo" on page 57
Troubleshooting motor fault error and power cycling	"Troubleshooting" on page 150

Performing commands using Bravo Diagnostics

About this topic

For development and troubleshooting purposes, you can use Bravo Diagnostics to perform tasks such as Aspirate, Mix, and Dispense. This topic describes how to execute commands from the Processes diagnostics tab.

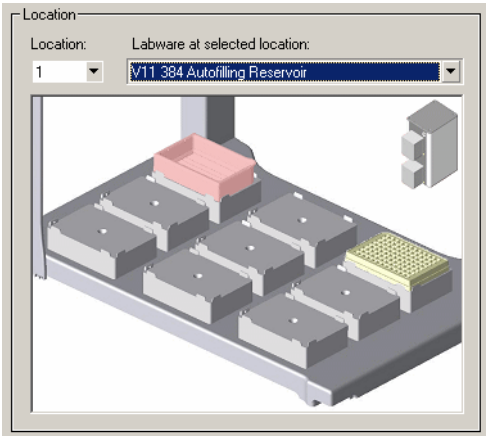
Performing a command requires that you:

- ❑ Choose a location
- ❑ Select a command and command parameters
- ❑ Select labware

Procedure

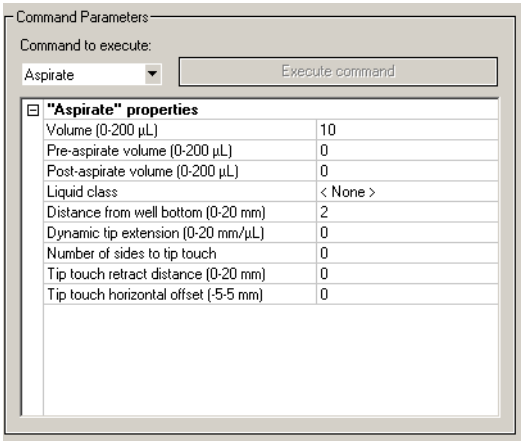
To perform a command from Bravo Diagnostics:

1. Open **Bravo Diagnostics** and click the **Processes** tab.
2. Select a location either by clicking on the visual display or selecting one from the **Location** list.



3. Select the labware from the **Labware at selected location** list box.

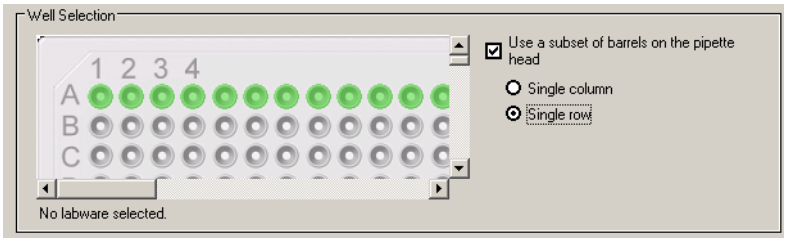
4. Select the command you want to execute from the **Command to execute** list.


Command Parameters
Command to execute:
Aspirate
Execute command
"Aspirate" properties
Volume (0-200 µL) 10
Pre-aspirate volume (0-200 µL) 0
Post-aspirate volume (0-200 µL) 0
Liquid class < None >
Distance from well bottom (0-20 mm) 2
Dynamic tip extension (0-20 mm/µL) 0
Number of sides to tip touch 0
Tip touch retract distance (0-20 mm) 0
Tip touch horizontal offset (-5-5 mm) 0

5. Select or enter the ***command*** **properties**.
6. *Series III pipette heads only.* If you want to pipette using one row or column of barrels instead of all barrels on the pipette head, select **Use a subset of barrels ...** and then **Single column** or **Single row**.

   Note: If you choose **Single row,** make sure you retract the stripper pins.
7. If you are using the head in serial mode, or if your head has fewer tips than the plate has wells, select the quadrant or quadrants of the plate you want to use.

   To select a quadrant, click a representative well. The selection appears below the diagram.



8. Click **Execute command**.

Related topics

For information about...	See...
Bravo task parameters	*VWorks User Guide*
Setting up the Bravo	“Setting up the Bravo” on page 57
Retracting the stripper pins	“Retracting tip-box stripper pins” on page 149

Managing profiles

About this topic

This topic describes how to copy, edit, delete, or rename profiles.

For example, you might have a new pipette head for the Bravo. Instead of creating a new one, it might be easier to start with a copy of an existing profile.

Procedure

To manage a profile:

1. Open **Bravo Diagnostics**.
2. In the **Device diagnostics** dialog box, click the **Profiles** tab.
3. Select one of the following options:

Option	Description
Create a copy of this profile	Creates a copy of the profile currently displayed in the **Profile name** field.
Rename this profile	Renames a profile. Type the desired name in the **Rename Profile** dialog box.
Delete this profile	Deletes a profile. A dialog message appears asking if you are sure you want to delete this profile.
Update this profile	Saves changes made to a profile, for example if you have changed a teachpoint for that profile.
Initialize this profile	Instructs the software to connect to the Bravo using the most recently saved values in the current profile.

Related topics

For information about...	See...
About profiles	*VWorks User Guide*
Creating a profile	“Creating a profile for the Bravo” on page 64
Setting up the Bravo	“Workflow for setting up the Bravo” on page 58

Bravo accessories 7

This chapter describes the accessories that can be used with the Bravo and provides the installation and removal procedures. This chapter contains the following topics:

- ❑ “About Bravo accessories” on page 110
- ❑ “Accessories Hub” on page 112
- ❑ “Alignment Station” on page 115
- ❑ “Auto Filling Reservoir” on page 117
- ❑ “Light Curtain” on page 119
- ❑ “Manual Fill Reservoir” on page 124
- ❑ “Microplate Vacuum Alignment Station” on page 125
- ❑ “MicroWash Reservoir” on page 128
- ❑ “Orbital Shaking Station” on page 130
- ❑ “Pump Module” on page 134
- ❑ “Tip Trash” on page 136
- ❑ “Vacuum Filtration Station” on page 138
- ❑ “Weigh Station” on page 140

About Bravo accessories

About this topic This topic describes the accessories that are available for the Bravo.

Description Bravo accessories are options that can be added to the Bravo to enhance existing functions and facilitate operation. The following table describes the accessories available for the Bravo. To order an accessory or to obtain the list of new accessories, contact Velocity11 Customer Service.

Accessory	Description	See...
Accessories Hub	Serves as a central connection point for the Bravo accessories and controlling computer.	"Accessories Hub" on page 112
Alignment Station	Positions 1536-well plates for precise pipetting.	"Alignment Station" on page 115
Auto Filling Reservoir	Supplies reagents to the pipette head. Used with a Pump Module to refill and drain reservoir automatically during a run. For use with 96-well and 384-well plates.	"Auto Filling Reservoir" on page 117
Light Curtain	Pauses or stops the operation if the operator reaches into the Bravo during a run.	"Light Curtain" on page 119
Manual Fill Reservoir	Supplies reagents to the pipette head. Requires manual refill and draining. Used with 96-well and 384-well plates.	"Manual Fill Reservoir" on page 124
Microplate Vacuum Alignment Station	Secures plates that are prone to warping.	"Microplate Vacuum Alignment Station" on page 125
MicroWash Reservoir (96-well or 384-well)	Washes the pipette tips during a run to prevent carryover and reduce cross-contamination. Used with a Pump Module.	"MicroWash Reservoir" on page 128
Orbital Shaking Station	Mixes plate contents using a shaking motion.	"Orbital Shaking Station" on page 130
Pump Module	Supplies fluids to, and removes waste from, the Auto Filling Reservoir, the MicroWash Reservoir, and the Weigh Station.	"Pump Module" on page 134
Tip Trash	Accepts used pipette tips during operation.	"Tip Trash" on page 136
Vacuum Filtration Station	Holds filter plates and applies vacuum for filtration.	"Weigh Station" on page 140

Accessory	Description	See...
Weigh Station	Monitors and maintains the liquid level in the Auto Filling Reservoir. Used with the Pump Module.	“Accessories Hub” on page 112

Related topics

For information about...	See...
Bravo hardware components	“Hardware overview” on page 13
Configuring the software to recognize the accessory	*VWorks User Guide*

Accessories Hub

About this topic

This topic describes the Accessories Hub, explains its use, and provides the installation and removal instructions.

Description

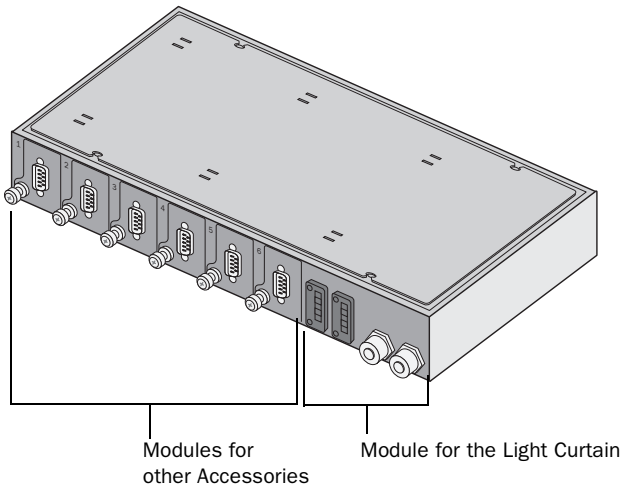
The Accessories Hub is a central electrical and communication connection point for a number of Bravo accessories and the controlling computer. You can customize the hub by installing the desired accessory modules to feed power or communication signals to the corresponding accessories. You use VWorks to configure and control the hub and the accessories.

The following accessories can be connected to the Accessories Hub.

- ❑ Light Curtain (optional)
- ❑ Microplate Vacuum Alignment Station (required)
- ❑ Orbital Shaking Station (optional)
- ❑ Vacuum Filtration Station (required)

Note: The hub is required for operating the Microplate Vacuum Alignment Station and the Vacuum Filtration Station.

The following diagram shows the Accessories Hub. The accessory modules are installed on the front of the hub.



Before you start

Make sure you have the following:

- ❑ Accessories Hub
- ❑ USB cable (supplied with the Accessories Hub)
- ❑ Power cord (supplied with the Accessories Hub)

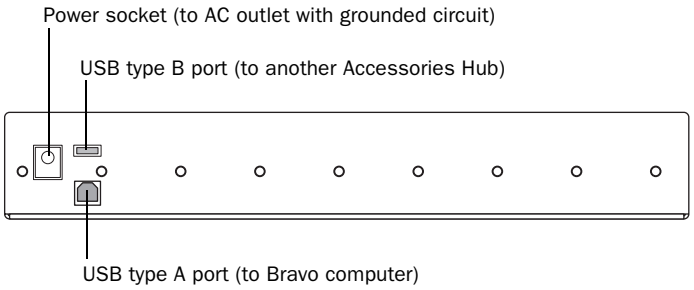
Procedure

!! INJURY HAZARD !! Turn off the Bravo before you install or remove any accessory.

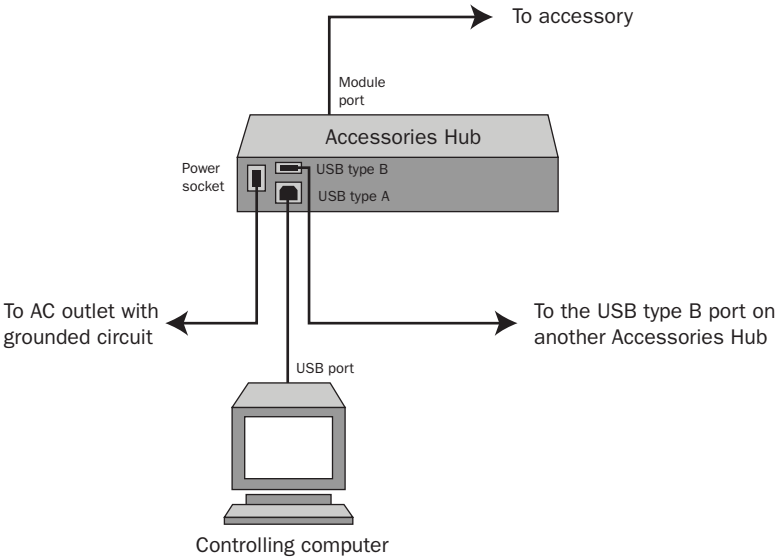
To install the Accessories Hub:

1. Connect the one end of the USB type A cable to the back of the Accessories Hub.
2. Connect the free end of the USB type A cable to the Bravo computer.
3. Connect the power cord to the back of the Accessories Hub.
4. *Optional.* Connect the USB type B cable from another Accessories Hub to the back of the Accessories Hub.
5. Connect the power cord to an AC outlet with grounded circuit.
6. Follow the instructions for the accessory to connect the accessory to the hub.

The following diagram shows the back of the Accessories Hub. Note the locations of the power socket, USB type A port, and USB type B port.


Power socket (to AC outlet with grounded circuit)
USB type B port (to another Accessories Hub)
USB type A port (to Bravo computer)

The following diagram shows the connections to the Accessories Hub.



To remove the Accessories Hub:

1. Follow the instructions for the accessory to disconnect the accessory from the Accessories Hub.
2. Disconnect the power cord from the AC outlet.
3. Disconnect the power cord from the Accessories Hub.
4. *Optional.* Disconnect the USB type B cable from another Accessories Hub.
5. Disconnect the USB type A cable from the Accessories Hub.
6. Disconnect the USB type A cable from the Bravo computer.

Related topics

For information about...	See...
Bravo hardware components	"Hardware overview" on page 13
Light Curtain	"Light Curtain" on page 119
Microplate Vacuum Alignment Station	"Microplate Vacuum Alignment Station" on page 125
Orbital Shaking Station	"Orbital Shaking Station" on page 130
Vacuum Filtration Station	"Vacuum Filtration Station" on page 138
Configuring the software to recognize the accessory	*VWorks User Guide*

Alignment Station

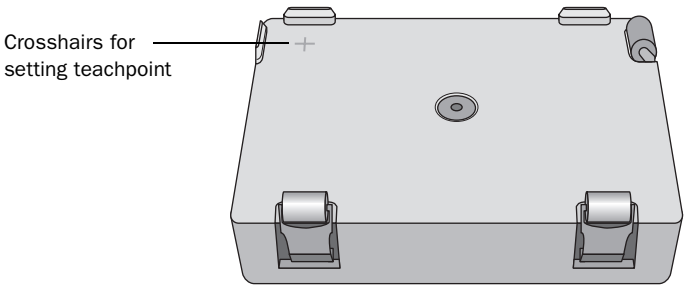
About this topic

This topic describes the Alignment Station, explains its use, and provides the installation and removal instructions.

Description

The Alignment Station is a platepad that has three springed rollers on two of the sides. The springed rollers are designed to push a plate into the opposing corner, securing the plate position and ensuring precise pipetting.

The Alignment Station is for use with 1536-well plates and any other plate requiring precision location. The station can be installed in place of a platepad on any of the nine deck locations.



Before you start

Make sure you have the following:

- ❑ Alignment Station
- ❑ M4 hex wrench

Procedure

!! INJURY HAZARD !! Turn off the Bravo before you install or remove the accessory.

To install an Alignment Station:

1. Using the M4 hex wrench, remove the screw in the center of the platepad.
2. Remove the platepad. Make sure the dowel pins under the platepad remain in the deck.
3. Place the Alignment Station on the same deck location. Make sure the crosshairs are toward the back side of the Bravo and the Alignment Station sits level on the deck.
4. Insert the supplied flathead cap screw into the center of the Alignment Station and use the M4 hex wrench to tighten the screw.
5. If you removed another accessory from this deck location immediately before installing the Alignment Station, edit the teachpoint for this location. If you removed a platepad before installing the Alignment Station, you do not need to edit the teachpoint.

To remove the Alignment Station:

1. Using the M4 hex wrench, remove the screw in the center of the Alignment Station.
2. Remove the Alignment Station.
3. Place the platepad on the same deck location. Make sure the crosshairs are toward the back side of the Bravo and the platepad sits level on the deck.
4. Insert the supplied flathead cap screw into the center of the platepad and use the M4 hex wrench to tighten the screw.

Related topics

For information about...	See...
Bravo hardware components	“Hardware overview” on page 13
Editing teachpoints	“Editing teachpoints” on page 68

Auto Filling Reservoir

About this topic

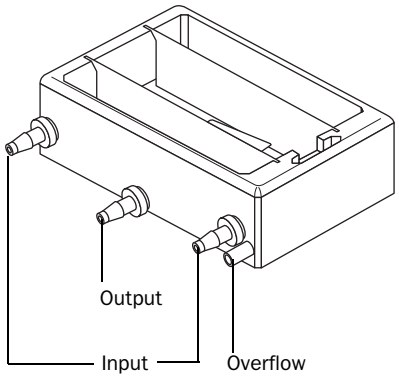
This topic describes the Auto Filling Reservoir, explains its use, and provides the installation and removal instructions.

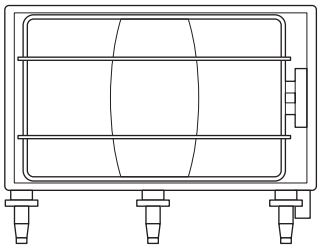
Description

The Auto Filling Reservoir is an open tray that has fluid input and output ports. Designed to be used with the Pump Module, the Auto Filling Reservoir supplies reagents to the pipette head through two of the ports and drains excess fluid through the third port. You can configure the software to automatically fill and drain the reservoir.

The Auto Filling Reservoir can be used with 96-well and 384-well pipette heads. It should be installed on top of a platepad at deck locations 1, 2, or 3.

The following diagram shows the ports at the back of the Auto Filling Reservoir. Note the locations of the input ports and the output port.





Top view (back)

Before you start

Make sure you have the following:

- ❑ Auto Filling Reservoir
- ❑ 1/4-in ID tubes (supplied with the Auto Filling Reservoir)
- ❑ Pump Module and supplied tubes

Procedure

!! INJURY HAZARD !! Turn off the Bravo before you install or remove the accessory.

To install the Auto Filling Reservoir:

1. Connect one end of the tubes to the Auto Filling Reservoir ports.
2. Place the reservoir on a platepad at deck location 1, 2, or 3.
3. Route the tubes from the Auto Filling Reservoir to the corresponding pumps (input and output) on the front of the Pump Module.

4. Connect the Pump Module to the Bravo, the fill bottle, and the waste bottle.

   See the Pump Module topic for detailed instructions.

5. Configure the Auto Filling Reservoir and set it up for automatic filling and draining in Bravo Diagnostics.

To remove the Auto Refill Reservoir:

1. Remove the reservoir from the platepad.
2. Discard the fluid in the reservoir according to applicable regulations.
3. Disconnect the tubes from the Auto Filling Reservoir ports.
4. Remove the tubes from the Pump Module.
5. Disconnect the Pump Module from the Bravo, the fill bottle, and the waste bottle.

   See the Pump Module topic for detailed instructions.

Related topics

For information about...	See...
Bravo hardware components	"Hardware overview" on page 13
Installing the Pump Module	"Pump Module" on page 134
Configuring the accessory in Bravo Diagnostics	❑ "Configuring an accessory" on page 96 ❑ *VWorks User Guide*

Light Curtain

About this topic

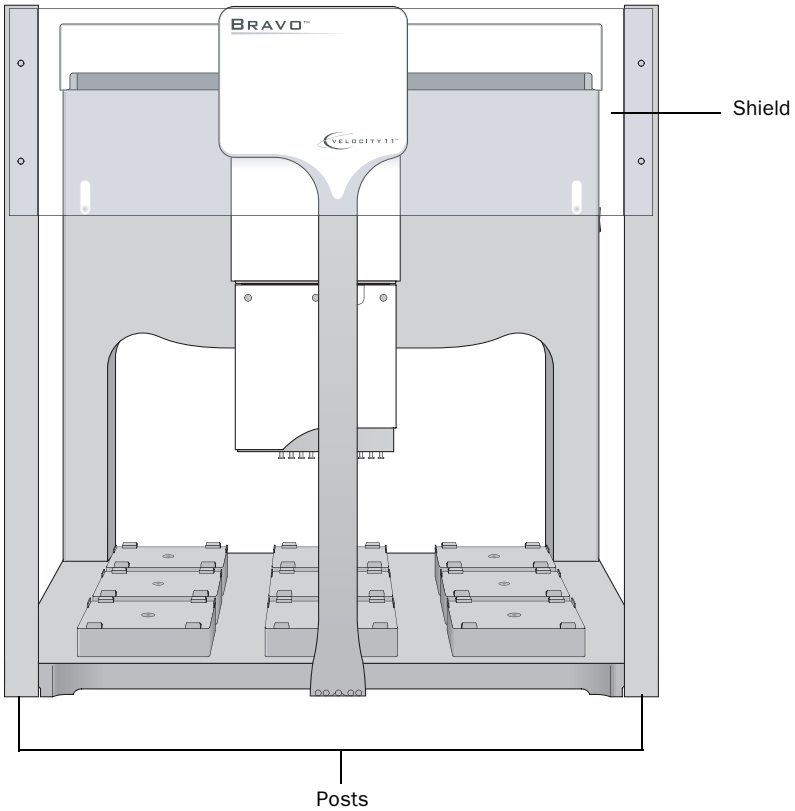
This topic describes the Light Curtain, explains its use, and provides the installation and removal instructions.

Description

The Light Curtain is a safety guard that functions like the disable button on the pendant. The Light Curtain is part of the safety interlock circuit that must be closed for the Bravo to operate. Designed to protect you from moving-part hazards while the Bravo is in operation, the Light Curtain detects interruptions in the light beams from the posts, breaks the safety circuit, and disables the pipette head motors.

!! INJURY HAZARD !! Do not replace the pendant with the Light Curtain. The Light Curtain is an additional safety feature to be used with the pendant.

The following graphic shows the front view of the Bravo with the Light Curtain installed.



Before you start

Make sure you have the following:

- ❑ Light Curtain
- ❑ Junction box (supplied with the Light Curtain) or Accessories Hub
- ❑ M3 hex wrench

Procedure

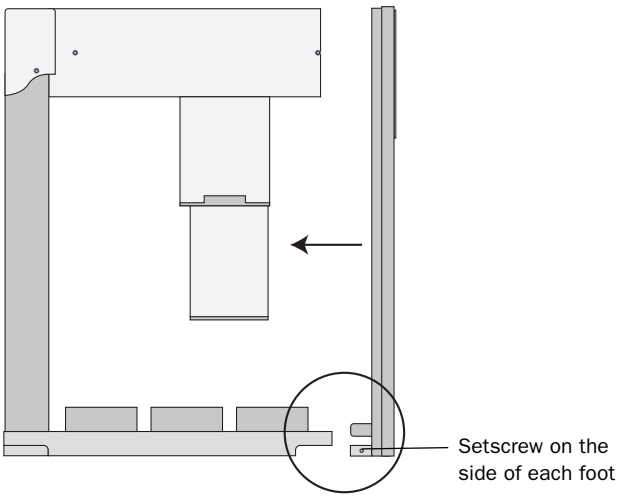
!! INJURY HAZARD !! Turn off the Bravo before you install or remove any accessory.

!! INJURY HAZARD !! Installing and removing the light curtain requires two people. Use care when you lift and move the light curtain to avoid physical injury and damage to the hardware.

To install the Light Curtain:

1. Position the Light Curtain in front of the Bravo. The plastic shield should be at the top and facing out. The feet should be pointed toward the Bravo.
2. Carefully move the Light Curtain toward the Bravo and insert the Bravo handles into the space in the Light Curtain feet.
3. Insert the setscrew into the side of each Light Curtain foot and use the M3 hex wrench to tighten the setscrew. This locks the Light Curtain into position.

   The following diagram shows the left side of the Bravo and the Light Curtain.



4. Disconnect the pendant from the back of the Bravo and connect it to the PENDANT port on the back of the junction box or on the front of the Accessories Hub.
5. Connect the two light post cables to the corresponding ports on the junction box or the Accessories Hub.
6. Connect one end of the jumper cable to the Pendant port on the back of the Bravo and the other end to the Bravo port on the junction box or Accessories Hub.

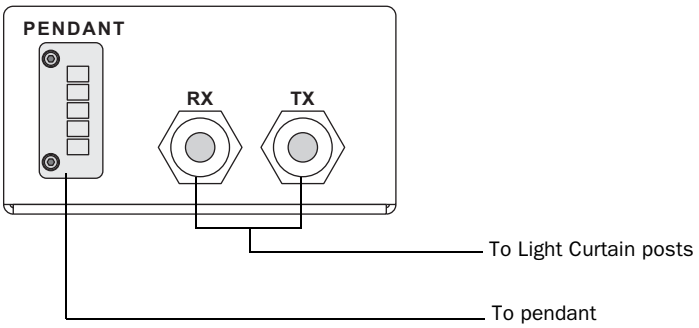
Note: The Light Curtain activates when you turn on the Bravo.

To remove the Light Curtain:

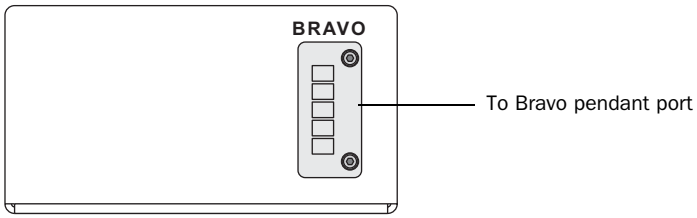
1. Disconnect the junction box or Accessories Hub from the Bravo.
2. Disconnect the light post cables from the junction box or Accessories Hub.
3. Disconnect the pendant from the junction box or Accessories Hub, and then connect it to the Bravo.
4. Remove the setscrew in the Light Curtain feet.
5. Carefully move the Light Curtain away from the Bravo.

Using a junction box

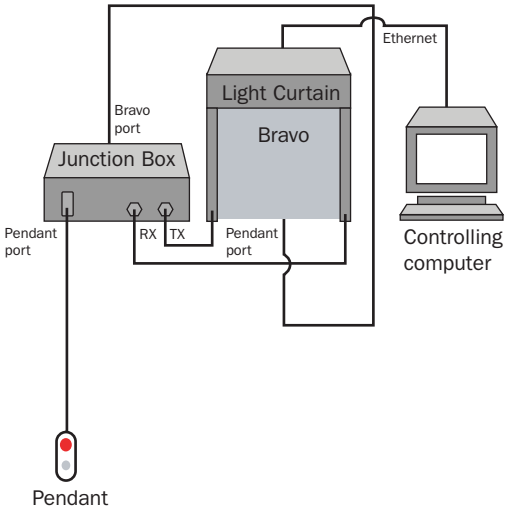
The following diagram shows the front of the junction box. The ports for the pendant cable and the two light post cables are on the front of the box.



The following diagram shows the back of the junction box. The port for the jumper cable is at the back of the box.

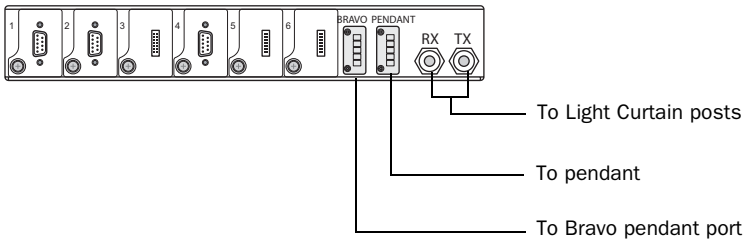


The following diagram shows the Light Curtain connected to a junction box.

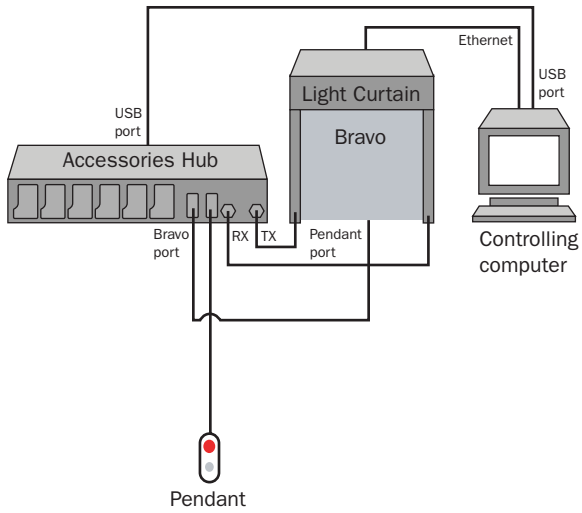


Using an Accessories Hub

The following diagram shows the front of the Accessories Hub and the ports relevant to the Light Curtain.



The following diagram shows the Light Curtain connected to an Accessories Hub.



Related topics

For information about...	See...
Bravo hardware components	“Hardware overview” on page 13
Connection port locations on the back of the Bravo	“Connection panel description” on page 21
Installing the Accessories Hub	“Accessories Hub” on page 112

Manual Fill Reservoir

About this topic

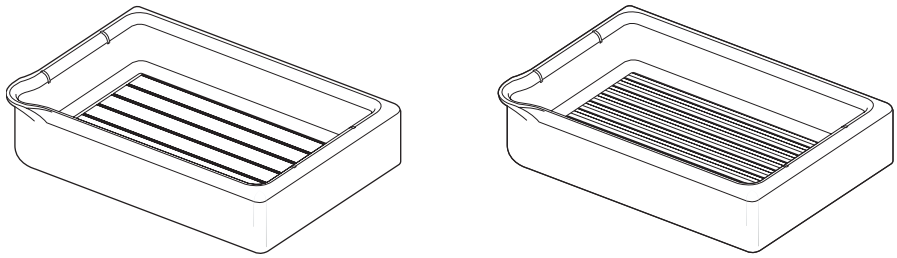
This topic describes the Manual Fill Reservoir, explains its use, and provides the installation and removal instructions.

Description

The Manual Fill Reservoir is an open tray that supplies reagents to the pipette head. You must manually refill and empty the reservoir.

The Manual Filling Reservoir can be used with 96-well and 384-well pipette heads and installed on top of a platepad or Alignment Station at any deck location.

The following diagrams show the two types of Manual Fill Reservoirs. The reservoir on the left is for 96-well plates. The reservoir on the right is for 384-well plates.



Procedure

!! INJURY HAZARD !! Turn off the Bravo before you install or remove any accessory.

To install the Manual Fill Reservoir, place the reservoir on a platepad. The reservoir can be in any orientation.

To remove the Manual Fill Reservoir, lift the reservoir from the platepad. Discard the fluid in the reservoir according to applicable regulations.

Related topics

For information about...	See...
Bravo hardware components	“Hardware overview” on page 13
Alignment Station	“Alignment Station” on page 115

Microplate Vacuum Alignment Station

About this topic

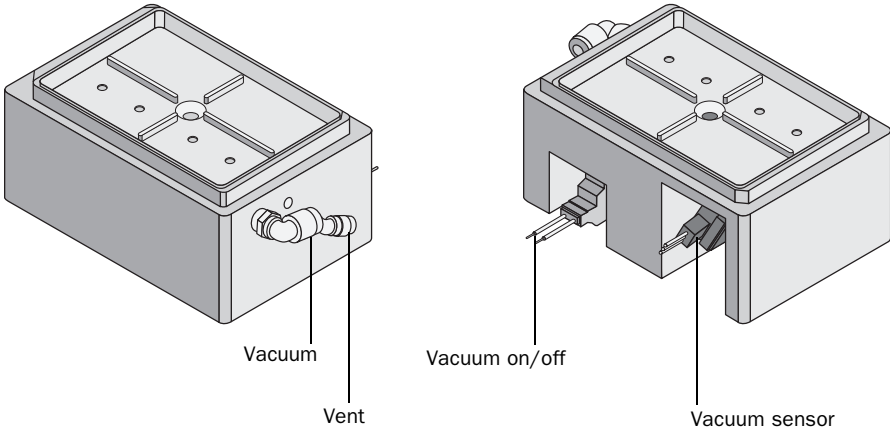
This topic describes the Microplate Vacuum Alignment Station, explains its use, and provides the installation and removal instructions.

Description

The Microplate Vacuum Alignment Station is a device that uses a vacuum to hold plates that tend to warp. Designed to be used with the Accessories Hub, the Microplate Vacuum Alignment Station can be installed in place of a platepad at any deck location.

Note: You might want to install the station on the outermost deck locations (1, 3, 4, 6, 7, or 9) so that the ports face either left (locations 1, 4, or 7) or right (locations 3, 6, or 9).

The following diagrams show the front of the Microplate Vacuum Alignment Station (left) and the back of the station (right).



Before you start

Make sure you have the following:

- ❑ Microplate Vacuum Alignment Station
- ❑ Flathead cap screw that holds the Vacuum alignment Station to the deck (supplied with the Microplate Vacuum Alignment Station
- ❑ M4 hex wrench
- ❑ Tube for the vacuum port
- ❑ Accessories Hub
- ❑ Vacuum source (house or pump)

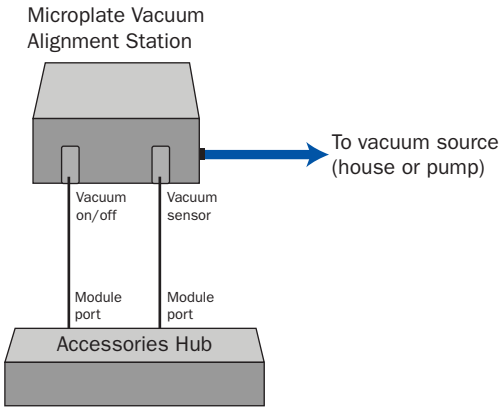
Procedure

!! INJURY HAZARD !! Turn off the Bravo before you install or remove any accessory.

To install the Microplate Vacuum Alignment Station:

1. Using the M4 hex wrench, remove the screw in the center of the platepad.
2. Remove the platepad. Make sure the dowel pins under the platepad remain in the deck.
3. Place the Microplate Vacuum Alignment Station on the same deck location.
4. Insert the supplied flathead cap screw in the center of the station and use the M4 hex wrench to tighten the screw.
5. Connect one end of the vacuum tube to the Microplate Vacuum Alignment Station.
6. Connect the free end of the vacuum tube to the vacuum source (house or pump).
7. Connect the vacuum on/off switch cable and the vacuum sensor cable from the back of the station to the corresponding ports on the Accessories Hub.
8. Edit the teachpoint of the Microplate Vacuum Alignment Station.

The following diagram shows the Microplate Vacuum Alignment Station connections.



To remove the Microplate Vacuum Alignment Station:

1. Disconnect the vacuum on/off switch cable and the vacuum sensor cable from the Accessories Hub.
2. Disconnect the vacuum tube from the vacuum source.
3. Disconnect the vacuum tube from the Microplate Vacuum Alignment Station.
4. Using the M4 hex wrench, remove the screw from the center of the station.
5. Remove the Microplate Vacuum Alignment Station.

6. Place the platepad on the same deck location.
7. Insert the supplied flathead cap screw into the center of the platepad and use the M4 hex wrench to tighten the screw.

Related topics

For information about...	See...
Bravo hardware components	“Hardware overview” on page 13
Accessories Hub	“Accessories Hub” on page 112
Configuring the software to recognize the accessory	*VWorks User Guide*
Editing teachpoints	“Editing teachpoints” on page 68

MicroWash Reservoir

About this topic

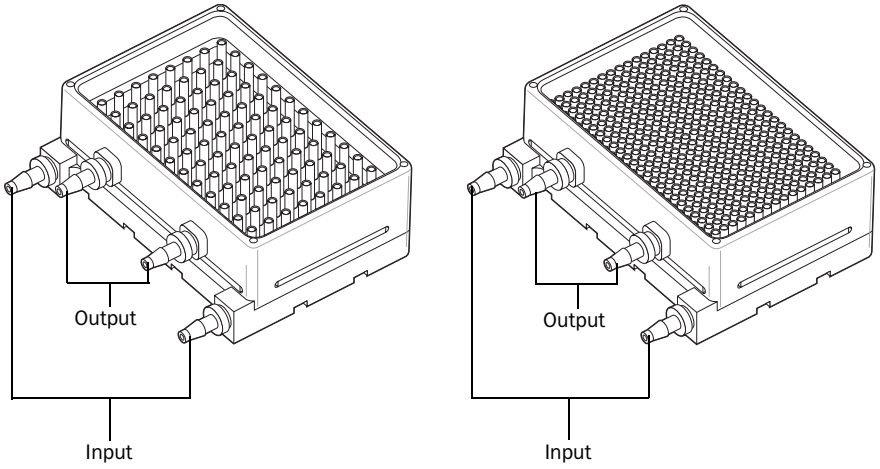
This topic describes the MicroWash Reservoir, explains its use, and provides the installation and removal instructions.

Description

The MicroWash Reservoir is a tray used to wash the pipette tips during a run. The chimneys in the reservoir are designed to prevent carryover and reduce contamination.

Two types of MicroWash Reservoirs are available: the 96-well and the 384-well. The reservoir type must match the pipette head you install for the run. The MicroWash Reservoir can be installed on a platepad at deck locations 1, 2, or 3.

The following diagrams show the two types of MicroWash Reservoirs. The reservoir on the left is for 96-well plates. The reservoir on the right is for 384-well plates.



Before you start

Make sure you have the following:

- ❑ MicroWash Reservoir
- ❑ 1/4-in ID tubes (supplied with the MicroWash Reservoir)
- ❑ Pump Module and supplied tubes

Procedure

!! INJURY HAZARD !! Turn off the Bravo before you install or remove any accessory.

!! DAMAGE HAZARD !! Make sure the reservoir type matches the pipette head you install for the run.

To install the MicroWash Reservoir:

1. Connect one end of the tubes to the MicroWash Reservoir ports.
2. Place the reservoir on a platepad at deck location 1, 2, or 3.

3. Route the tubes from the MicroWash Reservoir to the corresponding pump (input and output) on the front of the Pump Module.
4. Connect the Pump Module to the Bravo, the fill bottle, and the waste bottle.

   See the Pump Module topic for detailed instructions.
5. Configure the MicroWash Reservoir and set it up for automatic filling and draining in Bravo Diagnostics.

To remove the MicroWash Reservoir:

1. Remove the reservoir from the platepad.
2. Discard the fluid in the reservoir according to applicable regulations.
3. Disconnect the tubes from the MicroWash Reservoir ports.
4. Remove the tubes from the Pump Module.
5. Disconnect the Pump Module from the Bravo, the fill bottle, and the waste bottle.

   See the Pump Module topic for detailed instructions.

Related topics

For information about...	See...
Bravo hardware components	"Hardware overview" on page 13
Installing the Pump Module	"Pump Module" on page 134
Configuring the accessory in Bravo Diagnostics	❑ "Configuring an accessory" on page 96 ❑ *VWorks User Guide*

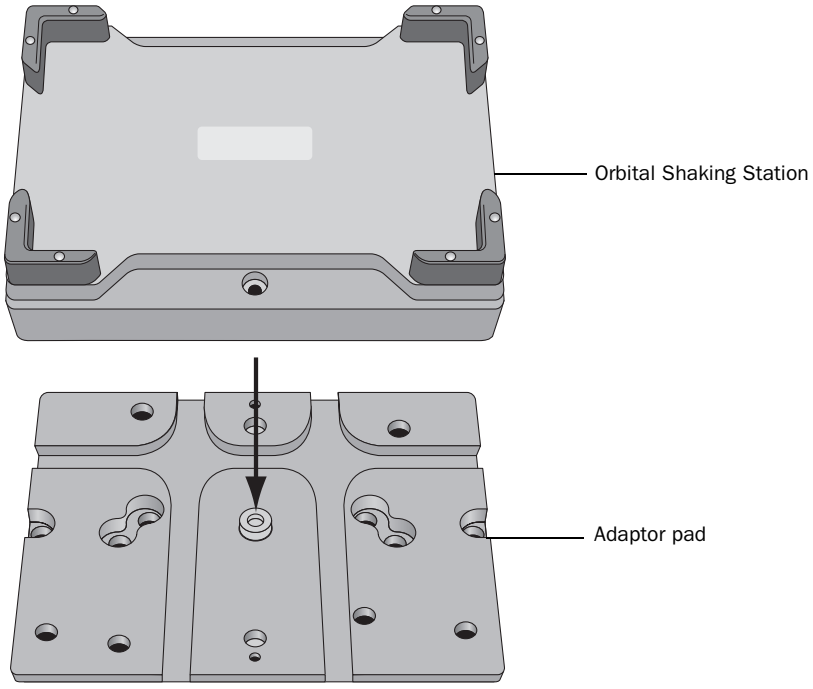
Orbital Shaking Station

About this topic

This topic describes the Orbital Shaking Station, explains its use, and provides the installation and removal instructions.

Description

The Orbital Shaking Station is a plate shaker that can be installed in place of a platepad in any deck location. For a full description of the Orbital Shaking Station, see the manufacturer's documentation.



Before you start

Make sure you have the following:

- ❑ Orbital Shaking Station
- ❑ Adaptor pad (supplied with the Orbital Shaking Station)
- ❑ Sockethead screw that holds the adaptor pad to the deck (supplied with the Orbital Shaking Station)
- ❑ M2 hex wrench
- ❑ M4 hex wrench
- ❑ M5 hex wrench
- ❑ Accessories Hub (optional)

Procedure

!! INJURY HAZARD !! Turn off the Bravo before you install or remove the accessory.

To install the Orbital Shaking Station:

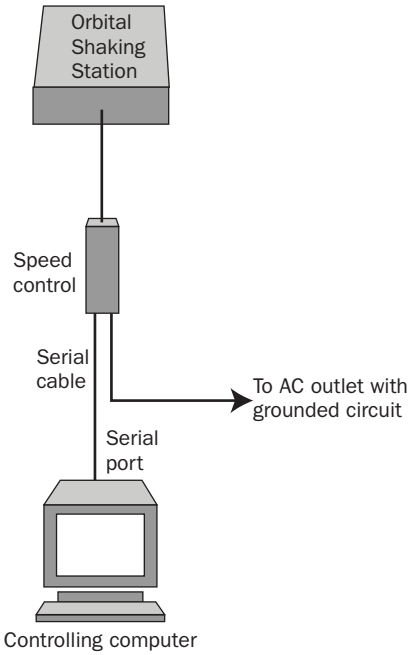
1. Using the M4 hex wrench, remove the screw in the center of the platepad and remove the platepad.
2. Place the adaptor pad in the same deck location.

   The adaptor pad can be in any orientation. Make sure the adaptor pad sits level on the deck.
3. Insert the larger sockethead screw into the center of the adaptor pad and use the M5 hex wrench to tighten the screw.
4. Place the Orbital Shaking Station on top of the adaptor pad.

   The station can be in any orientation. Make sure the station sits level on the adaptor pad.
5. Insert the two smaller sockethead screws into the holes at the front and back end of the adaptor pad and use the M2 hex wrench to tighten the screws.
6. Connect the serial cable from the speed control (on the power cord) to a serial port on the Bravo computer or on the Accessories Hub.
7. At the Orbital Shaking Station speed control (on the power cord), turn the speed dial to PC RS232 to turn off the speed and allow VWorks to control the Orbital Shaking Station.
8. Connect the Orbital Shaking Station power cord to an AC outlet with grounded circuit.
9. Configure the Orbital Shaking Station in Bravo Diagnostics and edit the teachpoint using the teach plate. Be sure to consider the 10-mm thickness of the teach plate when you edit the teachpoint.

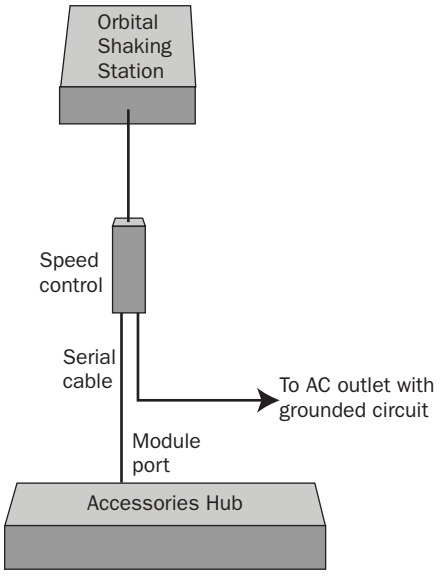
Connecting to the controlling computer directly

The following diagrams show the Orbital Shaking Station connected to the controlling computer.



Connecting to an Accessories Hub

The following diagrams show the Orbital Shaking Station connected to an Accessories Hub.



To remove the Orbital Shaking Station:

1. Disconnect the Orbital Shaking Station power cord from the AC outlet.
2. Disconnect the serial cable from the speed control (on the power cord) from the Bravo computer or the Accessories Hub.
3. Using the M2 hex wrench, remove the two sockethead screws in the Orbital Shaking Station.
4. Remove the Orbital Shaking Station from the adaptor pad.
5. Using the M5 hex wrench, remove the sockethead screw in the center of the adaptor pad.
6. Remove the adaptor pad.
7. Place the platepad on the same deck location.

   Make sure the crosshairs are in the upper left corner and the platepad is level on the deck.
8. Insert the supplied flathead cap screw into the center of the platepad and use the M4 hex wrench to tighten the screw.
9. Edit the teachpoint for the platepad.

Related topics

For information about...	See...
Bravo hardware components	"Hardware overview" on page 13
Accessories Hub	"Accessories Hub" on page 112
Configuring the accessory in Bravo Diagnostics	❑ "Configuring an accessory" on page 96 ❑ *VWorks User Guide*
Editing teachpoints	"Editing teachpoints" on page 68

Pump Module

About this topic

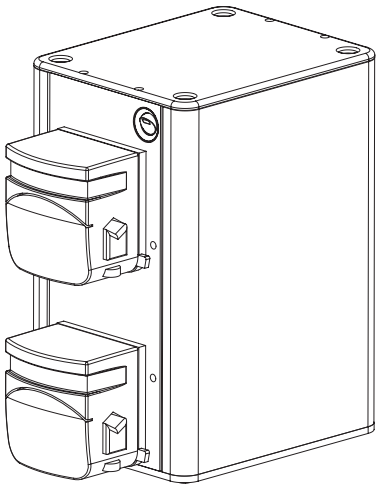
This topic describes the Pump Module, explains its use, and provides the installation and removal instructions.

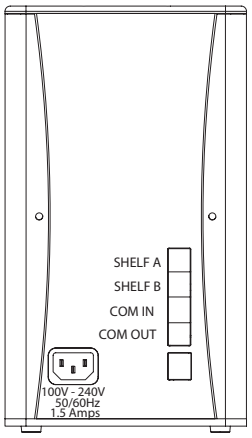
Description

The Pump Module is a device that transfers fluids into, and waste away from, the Auto Filling Reservoir, the MicroWash Reservoir, and the Weigh Station. The Pump Module contains two peristaltic pumps that are controlled using VWorks.

One Pump Module should be used for each pairing of reservoir and Weigh Station on the deck.

The following diagrams show the front (left) and the back (right) of the Pump Module.





Before you start

Make sure you have the following:

- ❑ Pump Module
- ❑ Tubes and/or cables required to connect an accessory to the Pump Module

Procedure

!! INJURY HAZARD !! Turn off the Bravo before you install or remove the accessory.

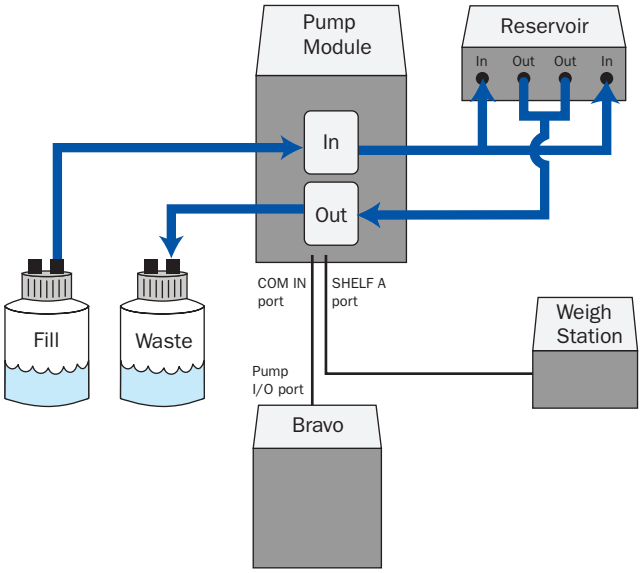
To connect the Pump Module to one of the reservoirs, route the input and output tubes from the reservoir to the corresponding pumps on the front of the Pump Module.

To connect the Pump Module to the Weigh Station, connect the RJ-45 cable from the Weigh Station to the SHELF A port on the back of the Pump Module.

Connect the pump I/O cable to the COM IN port on the back of the Pump Module. Connect the other end of the I/O cable to the Pump I/O port on the back of Bravo.

Connect the power cord to the back of the Pump Module. Connect the other end of the power cord to an AC outlet with grounded circuit.

Using multiple reservoirs and Weigh Stations requires multiple Pump Modules. The Pump Modules must be connected in series. To do this, call Velocity11 Technical Support.



Related topics

For information about...	See...
Bravo hardware components	"Hardware overview" on page 13
Auto Filling Reservoir	"Auto Filling Reservoir" on page 117
MicroWash Reservoir	"MicroWash Reservoir" on page 128
Weigh Station	"Weigh Station" on page 140
Configuring the software to recognize the accessory	*VWorks User Guide*

Tip Trash

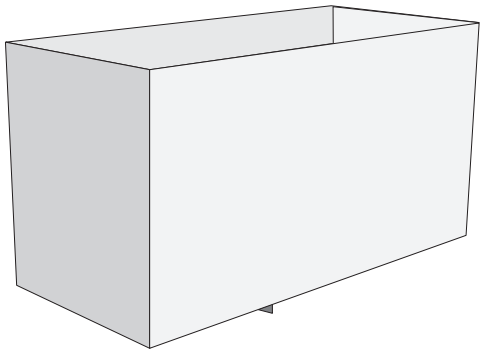
About this topic

This topic describes the Tip Trash, explains its use, and provides the installation and removal instructions.

Description

The Tip Trash is a receptacle used to contain used pipette tips. The Tip Trash should be installed in place of three platepads at deck locations 1, 4, and 7 (left side of the deck) or locations 3, 6, and 9 (right side of the deck).

The following diagram shows the Tip Trash.



Before you start

Make sure you have an M4 hex wrench.

Procedure

!! INJURY HAZARD !! Turn off the Bravo before you install or remove any accessory.

To install the Tip Trash:

1. Using the M4 hex wrench, remove the screw in the center of the platepads at deck locations 1, 4, and 7 or locations 3, 6, and 9.
2. Remove the dowel pins under the platepads.
3. Place the Tip Trash in the same deck locations by aligning the dowel pins under the Tip Trash with the dowel-pin holes in the deck.

To remove the Tip Trash:

1. Remove the Tip Trash from the deck.
2. Insert the platepad dowel pins in the deck.
3. Place the platepads on the deck locations.
4. Insert a supplied flathead cap screw into the center of each platepad and use the M4 hex wrench to tighten the screw.

Related topics

For information about...	See...
Bravo hardware components	“Hardware overview” on page 13

Vacuum Filtration Station

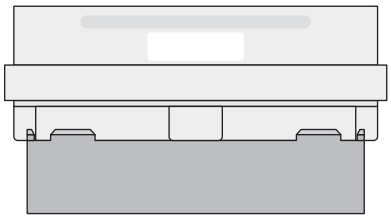
About this topic

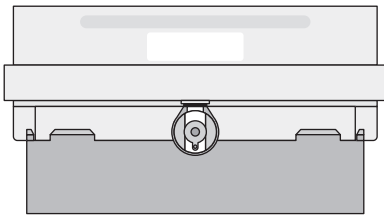
This topic describes the Vacuum Filtration Station, explains its use, and provides the installation and removal instructions.

Description

The Vacuum Filtration Station is a container that holds plates and applies vacuum to filter the plate contents. Designed to be used with the Accessories Hub, the Vacuum Filtration Station can be installed on the platepad at deck locations 1, 2, or 3 for optimum tube routing. For a full description of the Vacuum Filtration Station, see the manufacturer's documentation.

The following diagrams show the front (left) and the back (right) of the Vacuum Filtration Station.





Before you start

Make sure you have the following:

- ❑ Accessories Hub (required)
- ❑ Vacuum Filtration Station
- ❑ Vacuum Filtration Station kit (contains a pinch-valve module, tubes, waste bottle, and filter)
- ❑ M1.5 hex wrench
- ❑ Vacuum source (house or pump)

Procedure

!! INJURY HAZARD !! Turn off the Bravo before you install or remove the accessory.

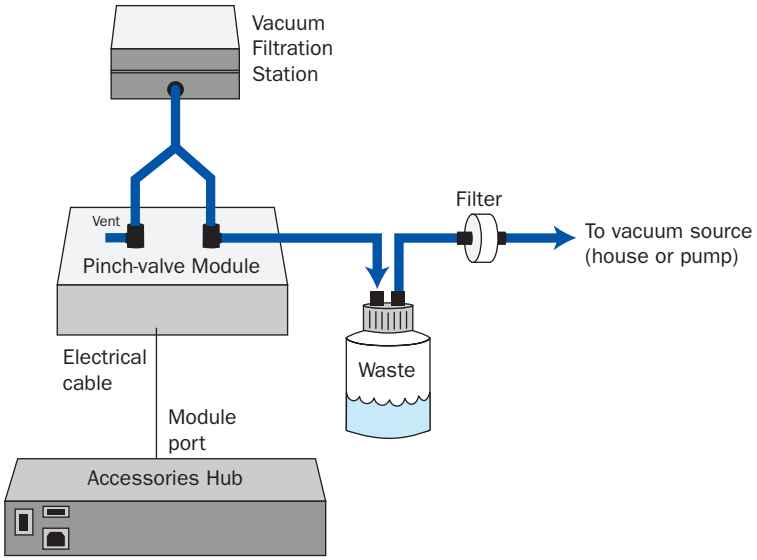
To install the Vacuum Filtration Station:

1. Place the Vacuum Filtration Station on the platepad at deck location 1, 2, or 3.

   The station can be in any orientation. Make sure the station sits level on the platepad.
2. Insert the setscrew and use the M1.5 hex wrench to tighten the screw.
3. Connect the tube with the quick-disconnect fitting to the port on the Vacuum Filtration Station.
4. Connect the free end of the kit assembly to the vacuum source.
5. Connect the electrical cable from the pinch-valve module to the Accessories Hub.

6. Turn on the vacuum.
7. Configure the Vacuum Filtration Station in Bravo Diagnostics and use the teach plate to edit the teachpoint. Make sure you consider the 10-mm thickness of the teach plate when you edit the teachpoint.

The following diagram shows the Vacuum Filtration Station connections.



To remove the Vacuum Filtration Station:

1. Turn off the vacuum.
2. Disconnect the electrical cable from the Accessories Hub.
3. Disconnect the kit assembly from the vacuum source.
4. Disconnect the tube from the Vacuum Filtration Station.
5. Remove the set screw that is holding the Vacuum Filtration Station to the platepad.
6. Remove the Vacuum Filtration Station from the platepad.
7. Discard the fluid in the reservoir according to applicable regulations.

Related topics

For information about...	See...
Bravo hardware components	“Hardware overview” on page 13
Accessories Hub	“Accessories Hub” on page 112
Configuring the accessory in Bravo Diagnostics	“Configuring an accessory” on page 96

Weigh Station

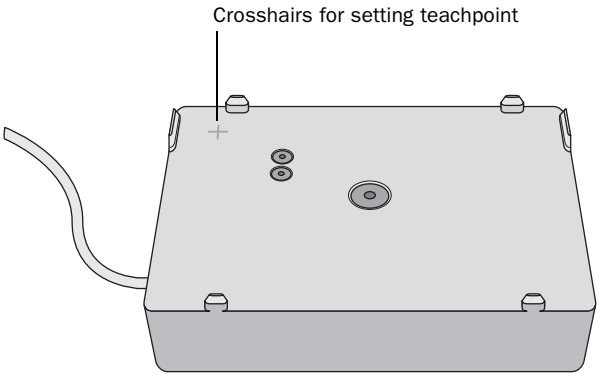
About this topic

This topic describes the Weigh Station, explains its use, and provides the installation and removal instructions.

Description

A Weigh Station is an electronic monitor that sits under a plate and checks the percentage of liquid in the plate. The Weigh Station looks like a platepad and can be installed at deck locations 1, 2, or 3.

The following diagram shows the Weigh Station.



Before you start

Make sure you have the following:

- ❑ Weigh Station
- ❑ Pump Module
- ❑ Sockethead screw (supplied with the Weigh Station)
- ❑ M4 hex wrench
- ❑ M5 hex wrench

Procedure

!! INJURY HAZARD !! Turn off the Bravo before you install or remove an accessory.

To install a Weigh Station:

1. Using the M4 hex wrench, remove the screw in the center of the platepad at deck location 1, 2, or 3.
2. Remove the platepad.
3. Place the Weigh Station in the same deck location.

   Make sure the side with the power cord faces the back of the Bravo and the Weigh Station sits level on the deck.
4. Insert the supplied sockethead screw into the center of the Weigh Station and use the M5 hex wrench to tighten the screw.
5. Connect the RJ-45 cable from the Weigh Station to the SHELF A port on the back of the Pump Module.

6. Connect the Pump Module to the Bravo, the fill bottle, and the waste bottle.

   See the Pump Module topic for detailed instructions.

7. Configure the Weight Station in Bravo Diagnostics and check the teachpoint.

To remove a Weigh Station:

1. Disconnect the Weigh Station from the Pump Module.
2. Disconnect the Pump Module from the Bravo, the fill bottle, and the waste bottle.

   See the Pump Module topic for detailed instructions.

3. Using the M5 hex wrench, remove the screw in the center of the Weigh Station.
4. Remove the Weigh Station.
5. Place the platepad in the same deck location.
6. Insert the flathead cap screw into the center of the platepad and use the M4 hex wrench to tighten the screw.

Related topics

For information about...	See...
Bravo hardware components	“Hardware overview” on page 13
Pump Module	“Pump Module” on page 134
Configuring the accessory in Bravo Diagnostics	“Configuring an accessory” on page 96
Editing teachpoints	“Editing teachpoints” on page 68

Maintenance and troubleshooting

8

This chapter tells you how to keep your Bravo in good working order through cleaning, inspection, and maintenance. It also explains what to do when you encounter a problem.

This chapter contains the following topics:

- ❑ "Routine maintenance" on page 144
- ❑ "Cleaning the Bravo" on page 145
- ❑ "Removing pipette heads" on page 146
- ❑ "Retracting tip-box stripper pins" on page 149
- ❑ "Troubleshooting" on page 150
- ❑ "Recovering from a head collision" on page 152

Routine maintenance

About this topic	This topic describes the routine maintenance and inspections that you should perform on your Bravo.
Routine maintenance	In general, practice good housekeeping by cleaning up spills and routinely cleaning the Bravo deck and pipette heads after using.
Inspection	Although there are no parts on the Bravo that wear out frequently or require regular replacement, you should periodically perform a visual check of the instrument. Look for corrosion on the deck and platepads and loose screws and bolts.
When to call Velocity11	Contact Velocity11 Technical Support if you are unable to resolve problems after consulting the user guide or online help.

Cleaning the Bravo

About this topic

This topic provides guidelines for cleaning the Bravo.

Cleaning guidelines

To clean the Bravo deck and other aluminum surfaces, you can use:

- ❑ Mild detergent
- ❑ Ammonia-based glass cleaner
- ❑ Mild organic solvents such as ethanol and propan-2-ol
- ❑ Bleach (sodium hypochlorite solutions)

On the white painted surfaces, only use mild detergent, glass cleaner, or ethanol.

Cleaning hazards

!! DAMAGE HAZARD !! Do not use harsh abrasives, corrosive cleaning agents, or metal brushes to clean any Bravo component or accessory.

!! INJURY HAZARD !! Disconnect the power and communication cables before cleaning.

Related topics

For more information about...	See...
Routine maintenance	“Routine maintenance” on page 144

Removing pipette heads

About this topic

This topic describes how to remove a pipette head. It includes information on removing and storing one pipette head.

Be sure to adjust your VWorks settings after installing a different pipette head.

Removing a pipette head

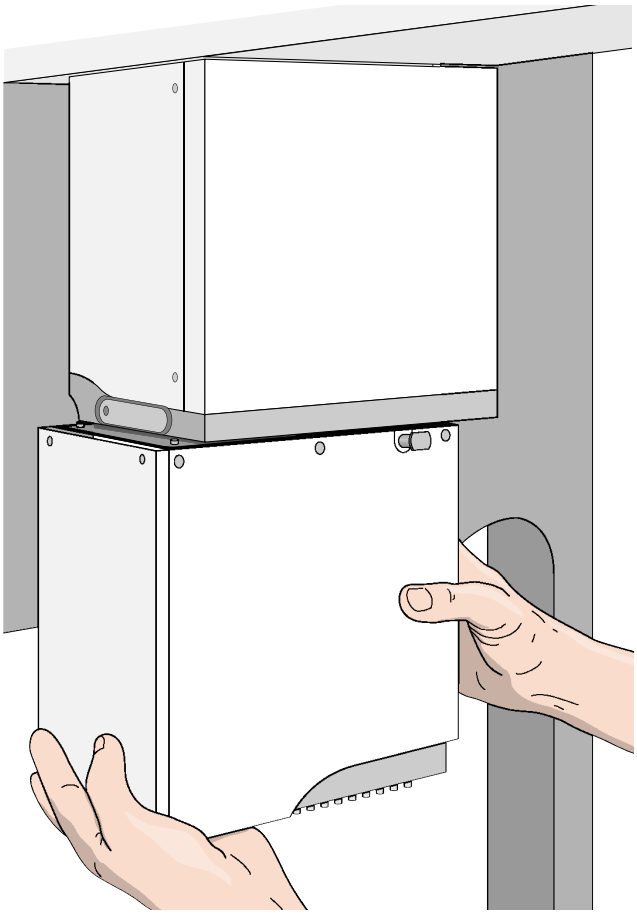
To remove a pipette head:

1. If there are disposable tips on the pipette head, remove them using the **Tips Off** command.
2. Make sure the head mount is in its home position above deck location 5.

   If it is not, use the **Home XYZ** command in Bravo Diagnostics.
3. Turn off the Bravo instrument.

   !! DAMAGE HAZARD !! Always turn off the Bravo before removing the pipette head. Failure to do this can damage the pipette head's electronics.
4. Pull out and twist the two head-retainer pins one-quarter turn so that they remain retracted.
5. Turn the head lock clockwise until it clicks into position.
6. Tug the pipette head to the left to release it.

   !! DAMAGE HAZARD !! Support the pipette head carefully without touching the barrels. Dropping it will damage the barrels or fixed tips.



7. Place the pipette head on the pipette-head stand for storage.

Installing a pipette head

Instructions for installing a pipette head are given in the chapter that describes the initial setup of the Bravo.

Adjusting VWorks settings for a new pipette head

After putting on a different pipette head, you need to adjust VWorks settings.

To adjust VWorks settings for a new pipette head:

1. Power up the Bravo.
2. In the Bravo device file, select the profile for the new pipette head, or open a device file with the correct profile for the new head.

   If this is the first time you have used this pipette head, you have to create a new profile.
3. Initialize the Bravo by clicking **Initialize selected devices** in the device file.
4. Open Bravo Diagnostics, and in the **Jog/Teach** tab, make sure that a value is displayed for each axis.

   This confirms communication between the Bravo and VWorks.

5. If you opened an existing device in step 2, go to the **IO/Configuration** tab and confirm that the location configuration graphic matches what you actually have on the Bravo's deck.

   (You may have changed the deck configuration since the device file was made.)

Related topics

For information about...	See...
Putting a pipette head on the Bravo	"Mounting the pipette head" on page 59
Executing the Tips Off task in Bravo Diagnostics	"Performing commands using Bravo Diagnostics" on page 105
Initializing the Bravo	"Preparing the Bravo for a run" on page 75
Homing the pipette head	"Homing the pipette head" on page 88
Available pipette heads	"The Bravo pipette heads" on page 18
Location of power switch, head mount	"Hardware overview" on page 13
Turning on the Bravo	"Turning on the Bravo" on page 63
Changing the profile	"Creating a profile for the Bravo" on page 64
Jog/Teach and IO/Configuration diagnostic tabs	"Using Bravo Diagnostics" on page 81

Retracting tip-box stripper pins

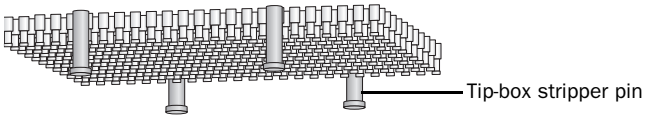
About this topic

This topic describes how to retract (and release) the stripper pins. Read this topic if you are using the pipette head to pipette in single rows.

About the stripper pins

The Bravo pipette heads have four pins that prevent the tip box from raising off the deck when tips are being applied. These pins are called the stripper pins.

If you are performing a task where the head pipettes by row, the stripper pins will interfere with this task unless they are moved out of the way.



Before you start

Make sure you have a 2 mm hex wrench.

Procedure

To retract the stripper pins:

1. Lay the pipette head on its side so that the barrels are facing you.
2. Insert the end of the hex wrench into the head of one of the pins.
3. Push the pin into the pipette head until you feel it stop.

   It should be nearly flush with the surface. If it is not flush, twist the pin in quarter turn increments, pushing in after each twist.
4. When the pin is properly seated, twist it, no more than 180°, until it locks.
5. Repeat the procedure for the other pins.

To release the pins, insert the hex wrench into the pin head, twist the wrench to release.

Related topics

For information about...	See...
Using the serial dilution task	*VWorks User Guide*
Setting the head mode to pipette by row	❑ *VWorks User Guide* ❑ "Performing commands using Bravo Diagnostics" on page 105
Removing and installing a pipette head	❑ "Removing pipette heads" on page 146 ❑ "Mounting the pipette head" on page 59

Troubleshooting

About this topic

This topic describes the most common problems and error messages that might be encountered with the Bravo and provides some possible solutions.

Troubleshooting table

Error message/problem	Cause	Recommended actions
Error message related to communication problems or failure.	Communications are interrupted.	❑ Turn off the Bravo off, and then turn it back on. ❑ Initialize the Bravo. (Click Initialize selected devices in the devices toolbar.)
The Bravo does not appear in the Discovered BioNet Devices dialog box. (Bravo Diagnostics > Profiles > Find available device).	Bravo is not communicating with VWorks.	Re-establish communication by: a. Clicking Refresh in the Discovered BioNet Devices dialog box. b. Turning off the Bravo, and then turning it back on. c. Clicking Refresh again. If that doesn't work, try one or more of the following. ❑ Check Ethernet cables between the Bravo and computer (and to and from hub if applicable). ❑ On the computer (and the hub, if applicable), check that the link light next to the Ethernet cable is on and green. ❑ In the Discovered BioNet Devices dialog box, check that the Select the Ethernet adapter... list is set appropriately. ❑ Make sure the Ethernet firewall is turned off. ("Turning off Ethernet firewall software" on page 55.) ❑ Use HyperTerminal to check that the IP address of the Bravo is set correctly. (See "Changing the Bravo's IP address to be assigned dynamically" on page 43.)

Error message/problem	Cause	Recommended actions
Head will not come off the head mount.	Firm attachment	❑ Make sure the head retainer pins are retracted. ❑ Make sure the head lock is in the unlocked position (horizontal). Jiggle the head side-to-side as you pull the head to the left.
Motor power fault error.	Problems with the Bravo's servo motors	Power cycle the Bravo: a. Turn the power switch off. b. Turn the power switch on. c. Initialize the device. If this happens a second time, contact Velocity11 Technical Support.
No power to the Bravo even though it is plugged in to a working power outlet.	Blown fuse	Use the spare fuse in the fuse holder to replace the blown fuse. If the fuse blows again, contact Velocity11 Technical Support. See "Connection panel description" on page 21 to locate the fuse holder.

Related topics

For information about...	See...
Discovered BioNet Devices dialog box	"Creating a profile for the Bravo" on page 64
Turning on the Bravo	"Turning on the Bravo" on page 63
Turning off the Bravo	"Shutting down the Bravo" on page 79
Preparing the Bravo for a run	"Preparing the Bravo for a run" on page 75
Hardware components	"Hardware overview" on page 13
Connecting Ethernet cables	"Connecting Ethernet cables" on page 49

Recovering from a head collision

About this topic

Occasionally, the Bravo pipette head might collide with an accessory or labware on a deck location because the accessory or labware has been misplaced or mistaught.

This topic describes what to do after a head collision has occurred.

Before you start

Before you start the inspection of the Bravo, clean up any spills that might have occurred as a result of the collision.

Procedure

To inspect the Bravo:

1. Inspect the impacted parts for visible signs of damage.

   Look carefully for any subtle signs of damage.
2. If contact was made to the pipette barrel or tip:
   a. Compare the impacted region to the surrounding barrels or tips.

      Dented barrels can affect tip sealing.
   b. Replace damaged tips or barrels if disposable.
   c. If fixed tips are damaged, contact Velocity11 Technical Support.

      Be ready to describe how the collision occurred.
3. If contact was made to a standard platepad, make sure the alignment tabs did not become damaged and still allow plates to be easily picked or placed.

   If the operation is hindered, contact Velocity11 Technical Support.
4. If contact was made to an Alignment Station, make sure the rollers and springs are not damaged and still allow plates to be easily picked and placed.

   If operation is hindered, contact Velocity11 Technical Support.
5. If contact was made to other deck locations, make sure the alignment tabs are not damaged and still allow plates to be easily picked and placed.

   Make sure the specific functionality of the deck location is not compromised. If the operation is hindered, contact Velocity11 Technical Support.

To verify system components are still working:

1. Jog each axis back and forth and listen for any new noise.

   If new noises are present or if any axis movement is impaired, contact Velocity11 Technical Support.
2. Make sure the Bravo alignment was not compromised:
   a. If the pipette head was impacted side-to-side, re-install the head.
   b. Attach the correct tip type.
   c. Move to the location you taught (typically location 5).

d. Check the alignment of the *x*- and *y*-axes.

   If the *x*- of *y*-axis are not aligned, contact Velocity11 Technical Support.

   Misalignment could be the result of a shift in the *x* or *y* screw in their mounts. Re-homing would reset the teach positions correctly but the mounts would still need to be retightened.

3. If the contact occurred in the vertical direction:
   a. Attach the correct tip type
   b. Move to location 8.
   c. Check the alignment of the *z*-axis.

      If the *z-axis* is out of alignment, contact Velocity11 Technical Support.

      The tie bar may need adjustment to align the *y* arm to be parallel with the deck.

Related topics

For information about...	See...
Removing and installing a pipette head	❑ "Removing pipette heads" on page 146 ❑ "Mounting the pipette head" on page 59
Checking axis alignment	"Editing teachpoints" on page 68

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Note: You can search our technical documentation on our website at www.velocity11.com.

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